



CONSTRUCTION PERMIT APPLICATION

C13-002024

Applicant Completes: Sections I, II, III (optional), IV, VI, and VII

I. IDENTIFICATION

1. Proposed Work Site at: 1691 Laurethon Street

2. Name of Owner in Fee: Jeffrey Gabriel

Tel. _____ e-mail _____

Address 1691 Laurethon St. Brick 08724

3. Ownership in Fee: Public _____ Private _____

4. Principal Contractor: **Roof Diagnostics Inc.** Tel. () _____

Address 2333 Highway 34 e-mail _____

Wall, NJ 08736

(732) 974-8874

License No. OR, if new home, Builder Reg. No. www.roofdiagnostics.com Exp. Date _____

Home Improvement Contractor Reg. No. 13VN00092200 (if applicable): _____

Federal Emp. ID No. _____ FAX: () _____

5. Architect or Engineer _____ Contact _____

Address _____ e-mail _____

Tel. () _____ FAX: () _____

6. Responsible Person in Charge once Work has Begun Millie Hawkins

Tel. (732) 387 5743 FAX: (732) 449 6731

V. FEE SUMMARY (for office use only)

		Update	Update
1. Building	\$ <u>90</u>	☒	
2. Electrical	\$ <u>200</u>	☒	
3. Plumbing			
4. Fire Protection			
5. Elevator Devices			
6. Subtotal			
7. Less 20% for State Plan Review	\$		
8. Subtotal	\$ <u>34</u>		
9. State Permit Surcharge Fee			
10. Subtotal	\$		
11. Cert. of Occupancy			
12. Other			
13. TOTAL	\$ <u>324</u>		

VI. BUILDING/SITE CHARACTERISTICS

(office use only)

1. Number of Stories _____

2. Height of Structure _____ ft.

3. Area — Largest Floor _____ sq. ft.

4. New Building Area _____ sq. ft.

5. Volume of New Structure _____ cu. ft.

6. Max. Live Load _____

7. Max. Occupancy Load _____

8. If Industrialized Building: State Approved _____ HUD _____

9. Total Land Area Disturbed _____ sq. ft.

10. Flood Hazard Zone _____

11. Base Flood Elevation _____ ft.

12. Wetlands yes _____ no _____

IIa. PROPOSED WORK

- ☐ Minor Work ☐ New Building ☐ Addition ☐ Demolition
- ☐ Repair ☐ Alteration ☐ Renovation ☐ Reconstruction
- ☐ Asbestos Abat. -Subch. 8 ☐ Lead Hazard Abatement ☐ Radon Remediation ☐ Annual Permit

IIb. SUBCODES

(Check all that apply)

- ☐ Building
- ☐ Electrical
- ☐ Plumbing
- ☐ Fire Protection
- ☐ Elevator

FOR OFFICE USE ONLY (Optional)

Est. Cost	Plans Rec'd by	Date Rec'd	Rejection Date	Approval Date	Re-viewer	Resubmission Dates Approval	Rejection	Re-viewer
	<u>JS</u>	<u>4/2/13</u>		<u>5/4/13</u>	<u>W</u>			
			<u>4-30-13</u>	<u>4-30-13</u>	<u>JS</u>			

TOTAL COST

20,000 Eng Exempt 4/29/13 etc

VII. DESCRIPTION OF BUILDING USE

A. RESIDENTIAL (primary use)

1. State Specific Use: _____
2. Use Group, Proposed: _____
3. Change in Use Group, Indicate Present: _____
4. No. of dwelling units: Total Units Income-restricted
- Gained, Sale _____
- Gained, Rental _____
- Lost, Sale _____
- Lost, Rental _____

B. NON-RESIDENTIAL (primary use)

1. State Specific Use: _____
2. Use Group, Proposed: _____
3. Change in Use Group, Indicate Present: _____

C. MIXED USE -List secondary use(s):

- D. Construct. Classification: Present _____ Proposed _____

III. PLAN REVIEW (optional)

DO YOU WANT:

1. ☐ Partial Releases
2. ☐ Prototype Processing

IV. DOES OR WILL YOUR BUILDING CONTAIN ANY OF THE FOLLOWING?

1. ☐ Elevators/Escalators/Lifts/ Dumbwaiters/Moving Walks
2. ☐ High Pressure Boilers
3. ☐ Pressure Vessels
4. ☐ Refrigeration Systems
5. ☐ Cross-Connections/Backflow Preventers
6. ☐ Hazardous Uses/Places of Assembly
7. ☐ Sprinklers/Standpipes
8. ☐ Smoke Control Systems in Open Wells
9. ☐ Underground Storage Tanks
10. ☐ Swimming Pools, Spas and Hot Tubs
11. ☐ LPGas Tanks
12. ☐ Fire Alarm



Brick Township
401 Chambersbridge Rd
Brick, NJ 08723

Date Issued 8/15/2013
Control Number C-13-002024
Permit Number 13-1948
Permit Issue Date 5/7/2013
Certificate Number 13-1948

Certificate
Construction Code Division
(Certificate of Approval)

Identification

Work Site Location: 1691 LAURELTON ST Brick Township, NJ Block: 844 Lot: 12 Qual: _____
Owner in Fee: GABRIEL, JEFFREY R & GRUSS, C A
Owner Address: 1691 LAURELTON ST BRICK NJ 08724
Telephone: [REDACTED]
Contractor ROOF DIAGNOSTICS
Address 608 BRIGHTON AVENUE SPRING LAKE Heights NJ 07762
Telephone: (732) 974-8874 Fax: (732) 449-6739
License Number or Builders Registration Number: 13VH00092200 Federal Emp. Number: 223324927

Home Warranty Number: _____

Type of Warranty Plan: ☐ State ☐ Private

Use Group: R-5

Construction Classification: _____

Maximum Live Load: 0

Maximum Occupancy Load: 0

Description of Work/Use: SOLAR PANELS

Certificate Comments:

☐ **Certificate of Occupancy**

This serves notice that said building or structure has been constructed in accordance with the New Jersey Uniform Construction Code and is approved for occupancy.

☒ **Certificate of Approval**

This serves notice that the work completed has been constructed or installed in accordance with the New Jersey Uniform Construction Code and is approved. If the permit was issued for minor work, this certificate was based upon what was visible at the time of inspection.

☐ **Certificate of Continued Occupancy**

This serves notice that based on a general inspection of the visible parts of the building there are no imminent hazards and the building is approved for continued occupancy.

☐ **Temporary Certificate of Compliance**

The following conditions must be met no later than or the owner will be subject to fine or order to vacate:

This certificate has an expiration date of:

Conditions to be met:

☐ **Certificate of Clearance - Lead Abatement 5:17**

This serves notice that based on written certification, lead abatement was performed as per NJAC5:17 to the following extent.

- ☐ Total removal of lead-based paint hazards in scope of work
☐ Partial or limited time period (years); see file

☐ **Certificate of Clearance - Asbestos Abatement**

This serves notice that based on written certification, asbestos abatement was performed to the following extent.

- ☐ Total removal of asbestos hazards in scope of work
☐ Partial or limited time period (years); see file

☐ **Certificate of Compliance**

This serves notice that said potentially hazardous equipment has been installed and/or maintained in accordance with the New Jersey Uniform Construction Code and is approved for use until

☐ **Temporary Certificate of Occupancy**

The following conditions must be met no later than: or the owner will be subject to fine or order to vacate:

This certificate has an expiration date of:

Conditions to be met:

Construction Official

Fee: \$0.00

Check Number: _____

Collected By: _____



CONSTRUCTION PERMIT

Date Issued
Control # C-13-002024
Permit #

13-1948

5-7-13

IDENTIFICATION Block: 844 Lot: 12 Qualifier
Work Site Location: 1691 LAURELTON ST Brick Township, NJ Contractor ROOF DIAGNOSTICS
Owner in Fee GABRIEL JEFFREY R & GRUSS, C.A Address 608 BRIGHTON AVENUE SPRING LAKE Heights NJ
1691 LAURELTON ST BRICK NJ 08724 Telephone: 07762
Telephone: [REDACTED] Lic. No. or Bldrs. Reg. No. 13VH00092200
Federal Employee No. 223324927

Is hereby granted permission to perform the following work:

- ☒ BUILDING ☐ PLUMBING ☐ LEAD HAZARD ABATEMENT
☒ ELECTRICAL ☐ FIRE PROTECTION ☐ DEMOLITION
☐ ELEVATOR DEVICES ☐ ASBESTOS ABATEMENT (Subchapter 8 only) ☐ OTHER

DESCRIPTION OF WORK:

SOLAR PANELS

Note: If construction does not commence within one (1) year of date of issuance, or if construction ceases for a period of six (6) months, this permit is void.

Estimated Cost of Work \$20,000

Daniel Newman Jr
Construction Official

Date 5/6/13

U.C.C. F170
equiv (rev 1/04)

1 WHITE - INSPECTOR

2 CANARY - OFFICE

3 PINK - TAX ASSESSOR

4 GOLD - APPLICANT

PAYMENTS (Office Use Only)

Building	\$90
Electrical	\$200
Plumbing	\$0
Fire Protection	\$0
Elevator Devices	\$0
Other	\$0.00
DCA Training Fee	\$34
CO Fee	
Other	\$0
Total	\$324
Check No. <u>97191</u>	
Cash	\$0
Credit	\$0
Collected By	

150
374

REQUIRED INSPECTIONS

Construction work must be inspected in accordance with the State Uniform Construction Code Regulations N.J.A.C. 5:23-2.18. This agency will carry out such periodic inspections during the progress of work as are necessary to insure that the work installed conforms with the requirements of the Uniform Construction Code.

The owner or other responsible person in charge of work must notify this agency when work is ready for any required inspections specified below. Requests for inspections must be made at least 24 hours prior to the time the inspection is desired. Inspections will be performed within three business days of the time for which they are requested. The work must not proceed in a manner which will preclude the inspection until it has been made and approval granted.

- ☒ Required inspections for all subcodes for one- and two-family dwellings are as follows:

- The bottom of footing trenches before placement of footings, except that in cases of pile foundations, inspections shall be made in accordance with the requirements of the building subcode.
- Foundations and all walls up to grade level prior to back filling.
- All structural framing, connections, wall and roof sheathing and insulation; electrical rough wiring, panel and service installation; rough plumbing. The framing inspection shall take place after the rough electrical and plumbing inspections and after the installation of the heating, ventilation and /or air conditioning duct system. The insulation inspection shall be performed after all other subcode rough inspections and prior to the installation of any interior finish material.
- Installation of all finished materials, sealings of exterior joints, plumbing piping, trim and fixtures; electrical wiring, devices and fixtures; mechanical systems equipment.

Additional required inspections for all subcodes of construction, for other than one- and two-family dwellings, are fire suppression systems, heat producing devices and Barrier Free subcode accessibility, if applicable.

- ☒ Required special inspections. The applicant by accepting the permit will be deemed to have consented to these requirements:
Rough electrical and building inspections must be scheduled at the same time. Contractor must be on site with a ladder at the time of inspection. Final inspections are required for Certificate of Approval.
- ☒ A final inspection is required for each applicable subcode area before a final Certificate of Occupancy or Approval may be issued. The final inspections include the installation of all interior and exterior finish materials, sealing of exterior joints, mechanical system and other required equipment; electrical wiring, devices and fixtures; plumbing pipes, trim and fixtures; tests required by any provision of the adopted subcodes, Barrier Free accessibility, if applicable; and verification of compliance with NJAC 5:23-3.5, "Posting structures".

- ☒ A complete copy of released plans must be kept on the job site.

If you do not understand any of this information, please ask.



Brick Township
401 Chambers Bridge Rd.

Brick, NJ 08723
(732) 262-1027

Date Issued:

Application Number: ZA-13-00408

Application Date: 04/27/2013

Project Number: _____

Permit Number: _____

Fee: \$50

Zoning Permit

Worksite **1691 LAURELTON ST**
Location: **Brick Township, NJ**

Block: 844

Lot: 12

Qualifier: _____

Zone: R-7.5

Owner: **GABRIEL, JEFFREY R & GRUSS, C A**
Address: **1691 LAURELTON ST**
BRICK, NJ 08724

Applicant: **Roof Diagnostics Solar & Electric, LLC**
Address: **2333 Route 34**
Wall, NJ 08736

Application Approved Date: 04/27/2013

This Certifies that an application for the issuance of a Zoning Permit has been examined.

Use is: Single-Family Residential

Nonconforming Use is: _____

Work Description:

Solar Energy System - 20 modules 250W Trina Solar, 5.00KW, mounted on the roof.

Upon review it was determined that the Development Application:

- ☒ Permitted by Ordinance
- ☐ Permitted by Variance approved on: _____
- ☐ Valid Nonconforming Use is established by
 - ☐ Zoning Board of Adjustment
 - ☐ Zoning Officer

Sean Kinney
Zoning Officer Sean Kinney

Michael P. Fowler
Michael P. Fowler, Township Planner

04/27/2013

Date

4/26/13
Date



Brick Township
401 Chambers Bridge Rd.

Brick, NJ 08723
(732) 262-1027

Date Issued:

Application Number: 5-7-13
ZA-13-00408

Application Date: 04/27/2013

Project Number:

Permit Number: 13-00343

Fee:

\$50

Zoning Permit

Worksite **1691 LAURELTON ST**
Location: **Brick Township, NJ**

Block: 844

Lot: 12

Qualifier:

Zone: R-7.5

Owner: **GABRIEL, JEFFREY R & GRUSS, C A**
Address: **1691 LAURELTON ST**
BRICK, NJ 08724

Applicant: **Roof Diagnostics Solar & Electric, LLC**
Address: **2333 Route 34**
Wall, NJ 08736

Application Approved Date: 04/27/2013

This Certifies that an application for the issuance of a Zoning Permit has been examined.

Use is: Single-Family Residential

Nonconforming Use is: _____

Work Description:

Solar Energy System - 20 modules 250W Trina Solar, 5.00KW, mounted on the roof.

Upon review it was determined that the Development Application:

- ☒ Permitted by Ordinance
- ☐ Permitted by Variance approved on: _____
- ☐ Valid Nonconforming Use is established by
 - ☐ Zoning Board of Adjustment
 - ☐ Zoning Officer

Sean Kinney
Zoning Officer Sean Kinney

04/27/2013

Date

Michael P. Fowler
Michael P. Fowler, Township Planner

4/25/13
Date



BUILDING SUBCODE TECHNICAL SECTION



A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTORS, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block 844 Lot 12 Qualification Code 0824

Work Site Location 1001 Laurethon Street

Owner in Care John Laurethon

Tel. [redacted] e-mail [redacted]

Address 2333 Highway 34 e-mail [redacted]

Contractor: Roof Diagnostics Inc. Tel. (732) 974-8874 zip code 08736

Address Wall, NJ 08736

Contractor License No. or Builder Registration No. 13VH00092200 Exp. Date [redacted]

Home Improvement Contractor Registration No. 13VH00092200 (if applicable): [redacted]

Federal Emp. ID No. [redacted]

Exp. Date [redacted]

Job Summary (Office Use Only)

PLAN REVIEW: Date 5/4/13 Initial W

☒ No Plans/Required W

☒ All 5/4/13 W

☒ Footings/Foundations W

☒ Structural/Framework W

☒ Exterior W

☒ Interior W

Joint Plan Review Required: W

☒ Elec. ☒ Plumb. ☒ Fire ☒ Elevator W

SUBCODE APPROVAL for PERMIT 05106113

Date: 05106113

Approved by: [signature]

SUBCODE APPROVAL for CERTIFICATE W

☒ CO ☒ CCO ☒ SA W

Date: 07/24/13

Approved by: [signature]

B. BUILDING CHARACTERISTICS

Use Group Present [redacted] Proposed [redacted]

No. of Stories [redacted]

Height of Structure [redacted] ft.

Area — Largest Floor [redacted] sq. ft.

New Bldg. Area/All Floors [redacted] sq. ft.

Volume of New Structure [redacted] cu. ft.

Constr. Class Present [redacted] Proposed [redacted]

If Industrialized Building: State Approved [redacted] HUD [redacted]

Est. Cost of Bldg. Work:

1. New Bldg. \$ 3,000

2. Rehabilitation \$ [redacted]

3. Total (1+2) \$ [redacted]

U.C.C. F110 (rev. 12/07)

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application.

Signature Muelu Hawken

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

Installation of Uninac flush roof mount sewer system

TYPE OF WORK:

☐ New Building

☐ Addition

☐ Rehabilitation

☐ Roofing

☐ Siding

☐ Fence [redacted] Height (exceeds 6') [redacted] Sq. Ft. [redacted]

☐ Sign [redacted] Sq. Ft. [redacted]

☐ Pool [redacted] Sq. Ft. [redacted]

☐ Retaining Wall [redacted] Sq. Ft. [redacted]

☐ Asbestos Abatement Subchapter 8 [redacted]

☐ Lead Haz. Abatement NJAC 5:17 [redacted]

☒ Radon Remediation [redacted]

☒ Other soil panels

☐ Demolition [redacted]

FEE (Office Use Only)

\$ [redacted]

Administrative Surcharge \$

Minimum Fee \$

State Permit Surcharge Fee \$

TOTAL FEE \$

1 White = Inspector Copy
3 Pink = Office Copy

2 Canary = Office Copy
4 Gold = Applicant Copy

Date Received 5-7-13
Control # 13-1948
Date Issued [redacted]
Permit # [redacted]



ELECTRICAL SUBCODE TECHNICAL SECTION



A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTOR, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block 844 Lot 1091 Location Laurelton Street Qualification Code 08734

Work Site Location 6141 Owner in Esc. John K. Kahl

Tel. [redacted] e-mail [redacted]

Address 3401

Contractor: Electrician's Solar & Electric, Inc. Tel. (732) 384-5243
Address Wall 2033 434 e-mail [redacted]

Contractor License No. 110337014 Exp. Date 2015

Home Improvement Contractor Registration No. or Exemption Reason (if applicable):

Federal Emp. ID No. 42-224 7978 FAX: ()

B. ELECTRICAL CHARACTERISTICS

Use Group Present Proposed [redacted]

[] Pole/Pad # [redacted] [] Temporary [] Other SP&C

Building Occupied as residence Utility Co. [redacted]

Est. Cost of Elec. Work \$ 17,000

JOB SUMMARY (Office Use Only)

PLAN REVIEW

[x] No Plans Required

[] Partial - Underslab Utilities Approved

Date: [redacted] Approved by: [redacted]

[x] Electric Plans Approved

Date: 4-30-13 Approved by: JS

Joint Plan Review Required:

[] Bldg. [] Plumb. [] Fire. [] Elev.

SUBCODE APPROVAL for PERMIT

Date: 4-30-13

Approved by: JS

SUBCODE APPROVAL for CERTIFICATE

[] CO [] CCO [] CA

Date: 8/15/13

Approved by: JS

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application and perform the work listed on this application.

Applicant's Signature/Contractor's Seal and Signature

[] Certified Landscape Irrigation Contractor [] Exempt Applicant

Licensed Elec. Contractor []

U.C.C. F120 (rev. 12/07) 1 White = Inspector Copy 2 Canary = Office Copy 3 Pink = Office Copy 4 Gold = Applicant Copy

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

Installation of 'unimac' flush roof
mount solar system

Date Received

Control #

Date Issued

Permit #

13-1948

5-7-13

QTY. SIZE ITEMS

Lighting Fixtures

Receptacles

Switches

Detectors

Light Poles

Motors—Fract. HP

Emergency & Exit Lights

Communications Points

Alarm Devices/F.A.C. Panel

TOTAL NUMBERS

Pool Permit/with UV Lights

Storable Pool/Spa/Hot Tub

KW Elec. Range/Receptacle

KW Oven/Surface Unit

KW Elec. Water Heater

KW Elec. Dryer/Receptacle

HP Garbage Disposal

KW Central A/C Unit

HP/KW Space Heater/Air Handler

KW Baseboard Heat

HP Motors 1/4 HP

AMP Service

AMP ~~Service~~ Generator

AMP ~~Service~~ microwaves

AMP Motor Control Center

KW Elec. Sign/Outline Light

15000 Solar panels

15000 Solar system

Administrative Surcharge \$

Minimum Fee \$

State Permit Surcharge Fee \$

TOTAL FEE \$

FEE (Office Use Only)

ENGINEERING PERMIT APPLICATION

RECEIVING CLERK _____
PERMIT # _____

BLOCK: 844 LOT: 12 ADDRESS: 1091 Laurelton St.

IDENTIFICATION:

1. WORK SITE ADDRESS: 1091 Laurelton St

2. NAME OF OWNER IN FEE: Jeffrey Samuel

ADDRESS: 1091 Laurelton St PHONE # 732 610 8257

Eric 08424 FAX # ()

3. PRINCIPAL CONTRACTOR: Kraftmagnetics Electric, LLC

ADDRESS: 2388 Route 34 PHONE # 732 884 5243

Ullal 08424 FAX # 732 449 4734

4. ARCHITECT OR ENGINEER: Tom Peterson

ADDRESS: 4 County Lane Howell 07734 PHONE # 732 730 1703

5. RESPONSIBLE PERSON FOR WORK: Kelley Payer

ADDRESS: 2388 Route 34 Ullal 08424

PHONE # () 322 5243 FAX # 732 449 4734 E-MAIL: eric@kraftmagnetics.com

PROJECT DESCRIPTION:

☐ SOIL REMOVAL/FILL ☐ RETAINING WALL ☐ POOL

☐ BULKHEAD/DOCK ☐ DWELLING ☐ TREE REMOVAL

☒ OTHER Installation of 'unimac' fusion roof mount solar system

LENGTH: _____ WIDTH: _____ HEIGHT: _____

ENGINEERING REVIEW:

DATE RECEIVED: _____ DATE REJECTED: _____ DATE APPROVED: _____ INITIALS: _____

FEE SUMMARY:

APPLICATION FEE: \$ _____

REVIEW FEE: \$ _____

INSPECTION FEE: \$ _____

OTHER: \$ _____

BOND(S): \$ _____

TOTAL: \$ _____

SPECIAL CONDITIONS:

OCEAN COUNTY SOILS: _____

DRAINAGE EASEMENTS: _____

UTILITY EASEMENTS: _____

CONSERVATION EASEMENTS: _____

FEMA REQUIREMENTS: _____

D.E.P. PERMITS: _____

BOARD APPROVAL: ☐ PB ☐ ZB

APPLICATION NUMBER: _____

APPROVED DATE: _____

Tom Petersen

Architects • Planners

Mr. Ken Anderson, Building Subcode Official
Brick Township Building Department
401 Chambersbridge Road
Brick, NJ 08723

March 30, 2013

Re: Solar Panel Installation
Gabriel Residence
1691 Laurelton Street
Brick, NJ 08724

Office Set

TOWNSHIP

RELEASED FOR PERMIT

Building Subcode 5/4/13 HW

Plumbing Subcode

Fire Subcode

Electrical Subcode

Plan Reviewer

Plans Released

Construction Official

Hi Ken,

I've reviewed the proposed solar panel installation at this location to evaluate the existing roof structure and the connection of the panels to the roof.

Criteria: Applicable codes: 2009 International Residential Code (New Jersey Edition)
2001 Wood Frame Construction Manual
Design roof load: 20 psf live load, 15 psf dead load, 35 psf total load
Design wind load: 120 mph, 35 psf

My findings are as follows.

1. The new solar panels will imply an additional dead load of 3 psf. Panels are mounted parallel to the roof plane, so additional live load due to wind uplift or downforce is negligible. The existing roof structure (2x8 roof rafters @ 16" o.c., with 2x4 collar ties @ 32" o.c. and 2x10 ridge, span = 14'-4") is sufficient to bear this additional load.
2. The solar panels are attached to the roof with the SolarMount-1 rack system by UNIRAC. The rack system, roof connections and connection spacing are rated for 120 mph. This project requires the larger Solar Mount I-2.5 beam (2.5" high) and spacing of flange foot connection to roof at 48" o.c. maximum. Flange footing connections to the rail are not required to be staggered. The flange foot connections to the roof are 3/8" diameter x 4" long lag bolts.

I therefore certify that this installation complies with the applicable codes and design loads mentioned above and is acceptable for approval. Please let me know if you have any questions on this information. Thanks!

Sincerely yours,

Tom Petersen
08201

Keley Pegler, Roof Diagnostics

6 Country Lane • Howell, New Jersey 07731 • Telephone 732-730-1763, Fax 732-730-1783

Mono

Multi

Solutions

TSM-PC05 TSM-PA05

THE UNIVERSAL SOLUTION

15.3%

MAX EFFICIENCY

250W

MAX POWER OUTPUT

10 YEAR

PRODUCT WARRANTY

25 YEAR

LINEAR POWER WARRANTY

Founded in 1997, Trina Solar is a vertically integrated PV manufacturer, involved in the production of ingots, wafers and cells to the assembly of high quality modules, using both mono and multicrystalline technologies. As of July 2011, the Company has already achieved an annualized nameplate module capacity of approximately 1.9GW. Trina Solar's wide range of products are used in residential, commercial, industrial and public utility applications throughout the world.

Only by matching an efficient cost-structure with proven performance will we as an industry achieve grid parity. And at Trina Solar, we have both.

Trina Solar Limited
www.trinasolar.com

Trina solar
The power behind the panel



Module can bear snow loads up to **5400Pa** and wind loads up to **2400Pa**



Guaranteed power output
0~+3%



High performance under low light conditions
Cloudy days, mornings and evenings



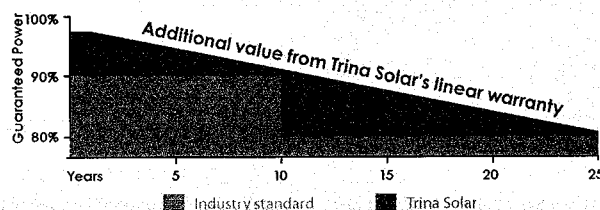
Independently certified by international certification bodies
IEC61215, IEC61730, UL1703, TUV Safety Class II, CE



Manufactured according to International Quality and Environment Management System Standards
ISO9001, ISO14001

LINEAR PERFORMANCE WARRANTY

10 Year Product Warranty • 25 Year Linear Power Warranty



NEW

THIS DOCUMENT IS PRINTED ON WATERMARKED PAPER, WITH A MULTICOLORED BACKGROUND AND MULTIPLE SECURITY FEATURES. PLEASE VERIFY AUTHENTICITY.

NOT AN
ELECTRICIAN'S
OR PLUMBER'S
LICENSE

State Of New Jersey
New Jersey Office of the Attorney General
Division of Consumer Affairs

THIS IS TO CERTIFY THAT THE
Division of Consumer Affairs

HAS REGISTERED

Roof Diagnostics Solar and Electric, LLC
Kelcy Pegler
608 Brighton Avenue
Spring Lake Heights NJ 07762

FOR PRACTICE IN NEW JERSEY AS A(N): Home Improvement Contractor

11/08/2012 TO 12/31/2013
VALID

13VH06478300
LICENSE/REGISTRATION/CERTIFICATION #

Signature of Licensee/Registrant/Certificate Holder

ACTING DIRECTOR

PLEASE DETACH HERE
IF YOUR LICENSE/REGISTRATION
CERTIFICATE ID CARD IS LOST
PLEASE NOTIFY:
Division of Consumer Affairs
P.O. Box 46016
Newark, NJ 07101

New Jersey Office of the Attorney General
Division of Consumer Affairs
THIS IS TO CERTIFY THAT THE
Division of Consumer Affairs
HAS REGISTERED
Roof Diagnostics Solar and Electric, LLC
Home Improvement Contractor

NOT AN ELECTRICIAN'S OR PLUMBER'S LICENSE

11/08/2012 TO 12/31/2013

VALID

SIGNATURE

13VH06478300

License/Registration/Certificate #

ACTING DIRECTOR

PLEASE DETACH HERE

State Of New Jersey
New Jersey Office of the Attorney General
Division of Consumer Affairs

THIS IS TO CERTIFY THAT THE
Board of Exam. of Electrical Contractors

HAS LICENSED

Joseph D. Doherty
172 Tiller Avenue
Manahawick NJ 08050

FOR PRACTICE IN NEW JERSEY AS A(N): Electrical Contractor

03/01/2012 TO 03/31/2015
VALID

34E101637800
LICENSE/REGISTRATION/CERTIFICATION #

Signature of Licensee/Registration/Certificate Holder
Joe Doherty

DIRECTOR
[Signature]

New Jersey Office of the Attorney General
Division of Consumer Affairs
THIS IS TO CERTIFY THAT THE
Board of Exam. of Electrical Contractors
HAS LICENSED
Joseph D. Doherty
Electrical Contractor

03/01/2012 TO 03/31/2015
VALID

34E101637800

License/Registration/Certificate #

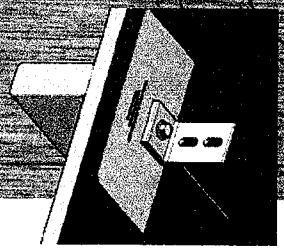
SIGNATURE

DIRECTOR

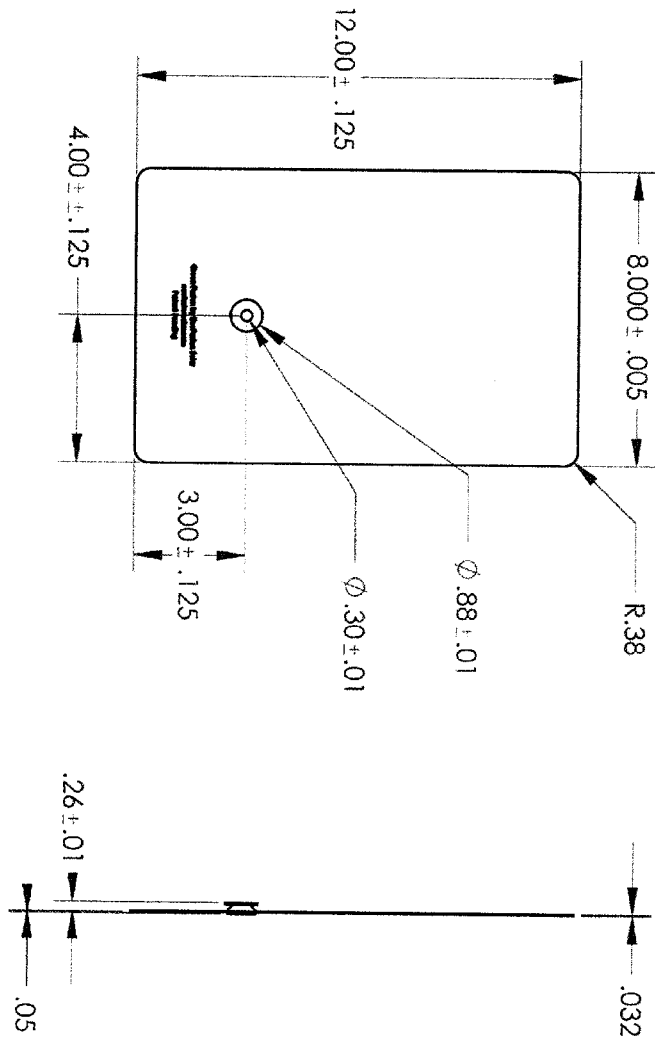
PLEASE DETACH HERE
IF YOUR LICENSE/REGISTRATION
CERTIFICATE ID CARD IS LOST
PLEASE NOTIFY:
Board of Exam. of Electrical Contractors
P.O. Box 45000
Hoboken, NJ 07101

PLEASE DETACH HERE

EcoFasten Solar



EcoFasten Solar® 877-859-3947 Committed to the Support of Renewable Energy



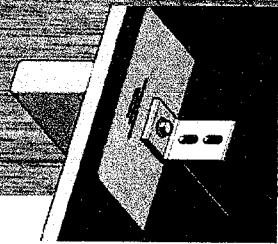
GREENFASTEN™ PRODUCT GUIDE – GF-I

GF-I-L 8/2

Finish Options

BLK = Matte Black
BRZ = Medium Bronze
MLL = Mill Finish

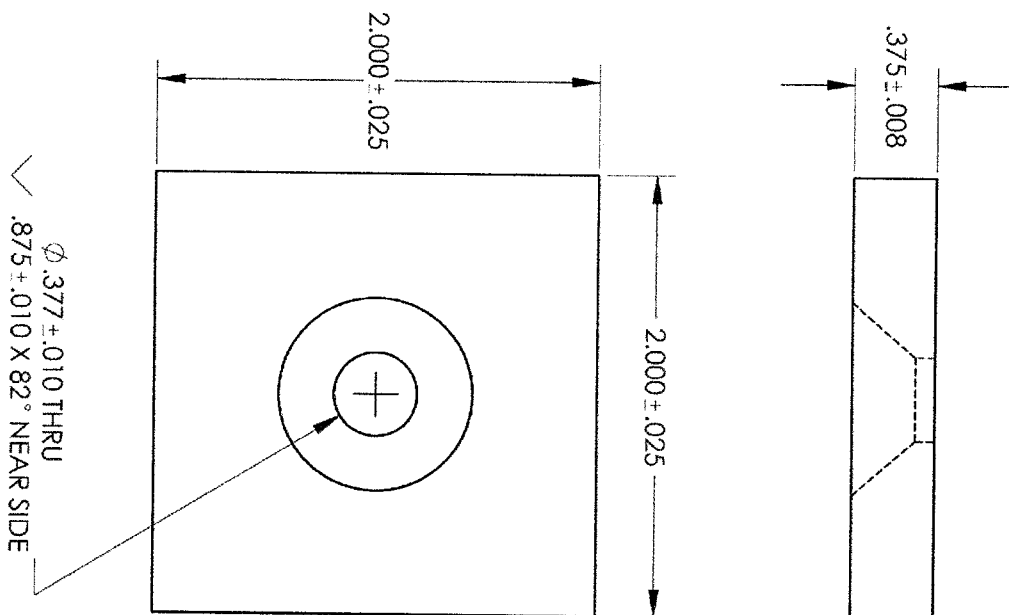
EcoFasten Solar



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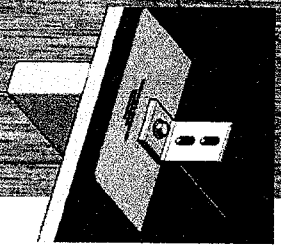
GREENFASTEN™ PRODUCT GUIDE – GF-1

Bracket Options - CP-SQ



Compression Plate 2" X 2" Mill Aluminum

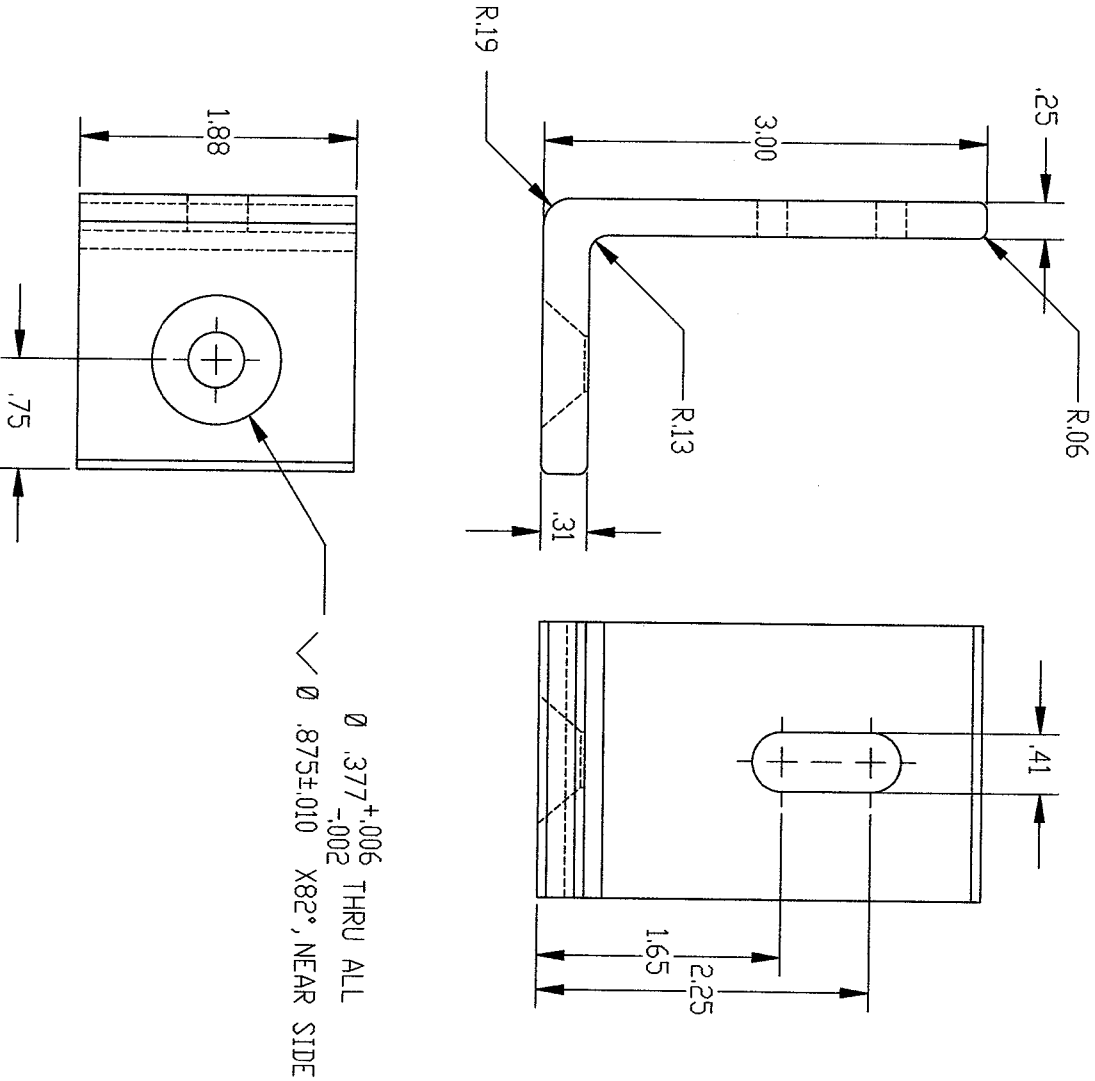
EcoFasten Solar



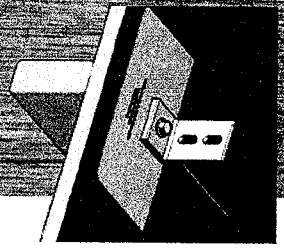
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GREENFASTEN™ PRODUCT GUIDE – GF-1

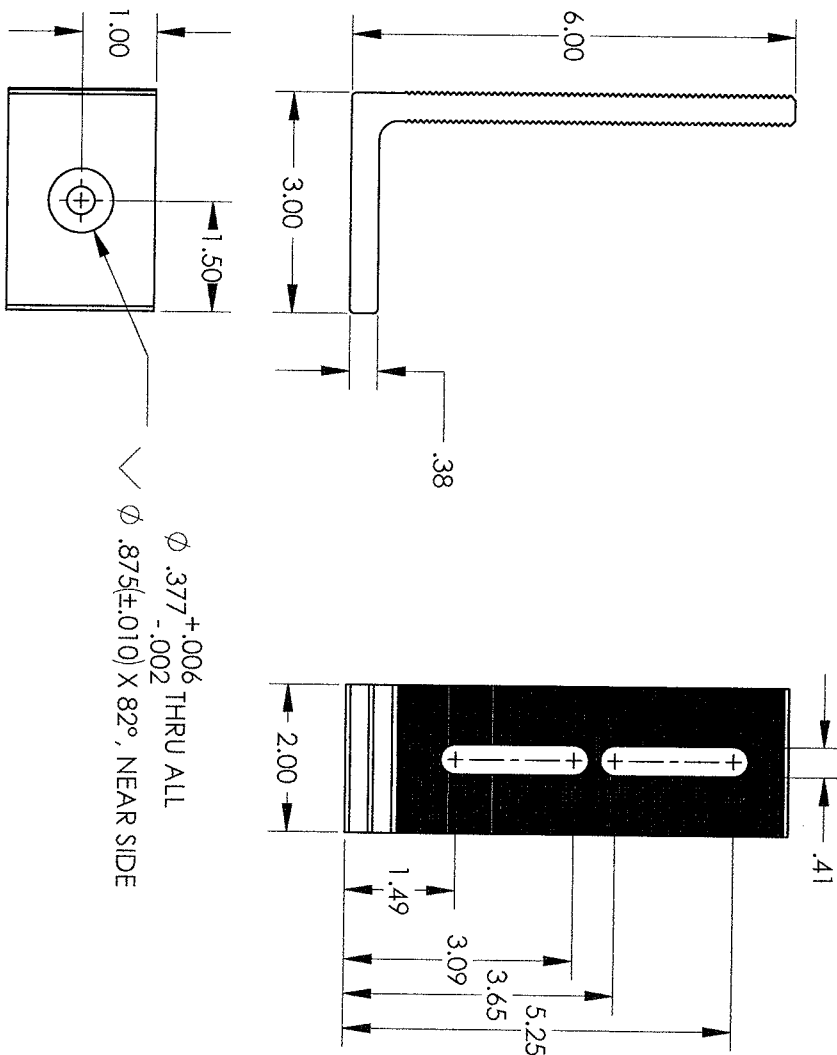
Bracket Options - L-101-3"



EcoFasten Solar



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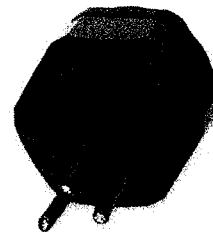
GREENFASTEN™ PRODUCT GUIDE – GF-1

Bracket Options - L-102-6"

Heyco®-Tite Solar Masthead® II Liquid Tight Cordgrips

Multi-Hole, NPT Hubs with Integral Sealing Ring - IP 68 Rated

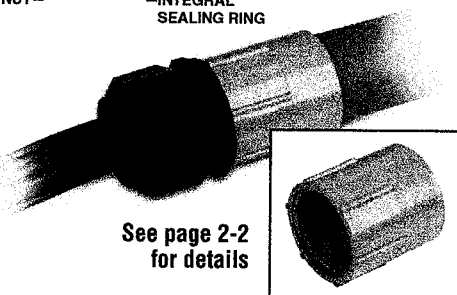
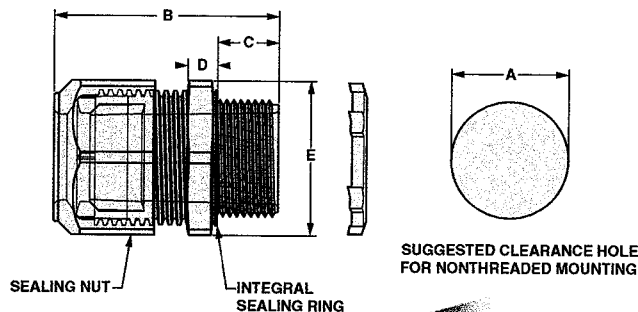
The Ultimate in Liquid Tight Strain Relief Protection



GLAND CONFIGURATION			PART NO.	DESCRIPTION	or Black	PART DIMENSIONS									
Size mm.	Type	No.				A	B	C	D	E					
						Clearance Hole Dia.	Max. O.A. Length	Thread Length	Thickness	Wrenching Nut Flat Size					
						in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
5.5	USE-2	5	M3234GBR-SM	SMCG 3/4	AL	1.04	26.4	2.00	50.8	.62	15.7	.25	6.4	1.30	33.0
		9	M8437GBK-SM	SMCG 1	AL	1.33	33.8	2.41	61.2	.76	19.3	.30	7.6	1.73	43.9
		13	M4524GBM-SM	SMCG 1-1/4	AL	1.68	42.7	2.69	68.3	.78	19.8	.30	7.6	2.05	52.1
		21	M3317GBQ-SM	SMCG 1-1/2	AL	1.92	48.8	2.81	71.3	.76	19.3	.36	9.1	2.48	63.0
5.6	USE-2	31	M3321GBY-SM	SMCG 2	AL	2.40	60.8	2.93	74.3	.79	20.1	.42	10.7	2.75	69.9
		3	M3200GAH-SM†	SMCG LL 1/2	AL	.87	22.2	1.68	42.7	.44	11.2	.25	6.4	1.06	27.0
7.7	PV 1000	3	M3234GBS-SM†	SMCG 3/4	AL	1.04	26.4	2.00	50.8	.62	15.7	.25	6.4	1.30	33.0
		5	M8437GBT-SM†	SMCG 1	AL	1.33	33.8	2.41	61.2	.76	19.3	.30	7.6	1.73	43.9
		9	M4524GBW-SM†	SMCG 1-1/4	AL	1.68	42.7	2.69	68.3	.78	19.8	.30	7.6	2.05	52.1
		11	M3317GBZ-SM†	SMCG 1-1/2	AL	1.92	48.8	2.81	71.3	.76	19.3	.36	9.1	2.48	63.0
		19	M3321GBX-SM†	SMCG 2	AL	2.40	60.8	2.93	74.3	.79	20.1	.42	10.7	2.75	69.9

*AWG 10 and 12 for both USE-2 and PV 1000.

† Certified by the Canadian Standards Association File 93876.
Assembled Metal Locknuts INCLUDED.



Use a Heyco-Flex I Conduit Adapter to join a Heyco Solar Masthead to Heyco-Flex I or Rigid PVC Conduit, through which the solar installer can run PV wire from the roof to the field level inverter.

Material



Nylon 6/6 with TPE or Buna N Sealing Glands
Listed under Underwriters' Laboratories File E51579

Certifications



Recognized under the Component Program of Underwriters' Laboratories
File E51579 to both Canadian and U.S. requirements

Flammability Rating

94-V2

Temperature Rating

-22°F (-30°C) to 212°F (100°C)

IP Rating

IP 68

- Integral Sealing Ring ensures a superior seal at the clearance or threaded mounting hole location, every time.
- IP 68 rated.
- **Break-Thru Skinned-Over glands** in the Solar Masthead II Cordgrips offer flexibility to use from 1 to 31 of the available holes while still providing a liquid tight seal around the wire.
- Provide a watertight seal for PV module output leads to inverters.
- Designed for use with 12 and 10 AWG USE-2 or 12 and 10 AWG 1000V PV wire.
- Designed for solar rooftop or combiner box installations.
- Secure input PV leads from solar panel array strings to fuse holder hookup within solar combiner boxes.
- Use in some residential rooftop solar applications may eliminate the need for combiner box when appropriate threaded adaptor is used.
- UV resistant nylon construction with TPE or Buna N Sealing Gland resists salt water, weak acids, gasoline, alcohol, oil, grease, and common solvents.
- No disassembly required for installation.
- Generous wrenching flats for ease of assembly.
- **Solar Masthead II Cordgrips provided with assembled metal locknut.**
- Contact Heyco for other sizes and gland configurations.
- Patent pending.



10 year limited Product Warranty

Unirac, Inc., warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, from the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance

with Unirac's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Unirac IN WRITING, or if the Product is installed in an environment for which it was not designed. Unirac shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by the Purchaser under any circumstances.

If within the specified Warranty period the Product shall be reasonably proven to be defective, then Unirac shall repair or replace the defective Product, or any part thereof, in Unirac's

sole discretion. Such repair or replacement shall completely satisfy and discharge all of Unirac's liability with respect to this limited Warranty. Under no circumstances shall Unirac be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Unirac's limited Warranty covers only its Product, and not any related items.



1411 Broadway Boulevard NE
Albuquerque NM 87102-1545 USA



State of New Jersey

DEPARTMENT OF COMMUNITY AFFAIRS

101 SOUTH BROAD STREET

PO Box 818

TRENTON, NJ 08625-0818

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

RICHARD E. CONSTABLE, III
Commissioner

October 17, 2012

Production Meter Requirements for Solar Projects and the Electrical Subcode

Recently, the New Jersey Board of Public Utilities (BPU) adopted new rules requiring that a revenue-grade meter (RGM) must be installed by November 30, 2012 so that all solar energy systems eligible to earn solar renewable energy credits (SRECs) can report system production. Credits are earned based upon readings obtained from a RGM measuring the system output.

Some of you may be thinking, isn't the system's inverter capable of displaying accumulated kilowatt-hours? This is true, however the accuracy of the inverter meter typically does not meet the American National Standards Institute (ANSI) Standard C12.1-2008 accuracy standards required by the NJ Clean Energy Program and therefore cannot be used for the purpose of generating SRECs.

So what does a RGM (aka, production meter) mean to you Mr. Electrical Subcode Official? It means, this meter is (1) in addition to the electric meter installed by the local utility to measure the home or business' electric consumption and (2) subject to the requirements of the Uniform Construction Code.

As mentioned earlier, the meter is required to meet the accuracy standard of the ANSI C12.1-2008 and is to be installed per the manufacturer's installation instructions. Even though a UCC permit will be issued for the meter's installation, the Department has determined that the listing/labeling requirements per Sections 90.7 and 110.3(B) of the electrical subcode would not be applicable. Therefore, when a RGM is installed in a new or existing solar energy system, the electrical subcode official only needs to verify that the RGM meter meets the ANSI standard and that it is compatible with the listed meter socket cabinet. A certification from an electrical contractor or a manufacture that the RGM installed meets ANSI C12.1-2008 should be acceptable for compliance to the standard.

The BPU has provided two lists (see links below) intended to assist you in identifying a RGM that meets these accuracy requirements. These lists are not to be considered as being all-inclusive. The first link is from the New York State Department of Public Service and the second link is from the California Energy Commission:

http://www.njcleanenergy.com/files/file/Renewable_Programs/REIP/Approved_%20Meter_%20List.pdf

http://www.gosolarcalifornia.org/equipment/system_perf.php

If you have any further questions regarding this matter, please contact the Code Assistance Unit at (609) 984-7609 or Office of Regulatory Affairs (609) 984-7768.

Source: Ken Verbos
Office of Regulatory Affairs



SIMPull THHN

Conductor		Insulation Thickness (mils)	Jacket Thickness (mils)	Nominal O.D. (mils)	Approx. Weight per 1000' (lbs)	Allowable Ampacities+			Standard Package
Size (AWG or kcmil)	Number of Strands					60° C	75° C	90° C	
14*	1	15	4	102	15	15	15	15	AC
12*	1	15	4	119	23	20	20	20	AC
10*	1	20	4	150	36	30	30	30	AC
14*	19	15	4	109	16	15	15	15	AC
12*	19	15	4	128	24	20	20	20	AC
10*	19	20	4	161	38	30	30	30	AC
8	19	30	5	213	63	40	50	55	ABCD
6	19	30	5	249	95	55	65	75	ABCD
4	19	40	6	318	152	70	85	100	ABCD
3	19	40	6	346	189	85	100	115	ABCD
2	19	40	6	378	234	95	115	130	ABCD
1	19	50	7	435	299	110	130	145	ABCD
1/0	19	50	7	474	372	125	150	170	ABCD
2/0	19	50	7	518	462	145	175	195	ABCD
3/0	19	50	7	568	575	165	200	225	ABCD
4/0	19	50	7	624	718	195	230	260	ABCD
250	37	60	8	694	851	215	255	290	ABCD
300	37	60	8	747	1012	240	285	320	ABC
350	37	60	8	797	1174	260	310	350	ABC
400	37	60	8	842	1334	280	335	380	ABC
500	37	60	8	926	1655	320	380	430	ABCD
600	61	70	9	1024	1987	350	420	475	ABC
750	61	70	9	1126	2464	400	475	535	BC
1000	61	70	9	1275	3257	455	545	615	C

* Sizes 14 - 10 AWG available with patented Sim Technology® No Lube® jacket only in SIMpull® Wire Barrel configurations.

+Allowable ampacities shown are for general use as specified by the 2011 Edition of the National Electrical Code Section 310.15 and 240.4(D). Unless the equipment is marked for use at higher temperatures the conductor shall be limited to the following per NEC 110.14(C).

60° C - When terminated to equipment for circuits rated 100 amperes or less or marked for 14 - 1 AWG conductors.

75° C - When terminated to equipment for circuits rated over 100 amperes or marked for conductors larger than 1 AWG.

90° C - THHN dry locations and THWN wet or dry locations for ampacity adjustment purposes using NEC section 310.15.

Standard Package:
A - 2500' Reel
B - 1000' Reel
C - 500' Spool
D - 5000' Reel

i. Installer's Responsibilities

Please review this manual thoroughly before installing your SolarMount system.

This manual provides (1) supporting documentation for building permit applications relating to Unirac's SolarMount Universal PV Module Mounting system, and (2) planning and assembly instructions for SolarMount

SolarMount products, when installed in accordance with this bulletin, will be structurally adequate and will meet the structural requirements of the IBC 2009, ASCE 7-05 and California Building Code 2010 (collectively referred to as "the Code"). Unirac also provides a limited warranty on SolarMount products (page 26).

SolarMount is much more than a product.

It's a system of engineered components that can be assembled into a wide variety of PV mounting structures. With SolarMount you'll be able to solve virtually any PV module mounting challenge.

It's also a system of technical support: complete installation and code compliance documentation, an on-line SolarMount Estimator, person-to-person customer service, and design assistance to help you solve the toughest challenges.

This is why SolarMount is PV's most widely used mounting system.



The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any that may supersede this manual;
- Ensuring that Unirac and other products are appropriate for the particular installation and the installation environment;
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure);
- Using only Unirac parts and installer-supplied parts as specified by Unirac (substitution of parts may void the warranty and invalidate the letters of certification in all Unirac publications);
- Ensuring that lag screws have adequate pullout strength and shear capacities as installed;
- Verifying the strength of any alternate mounting used in lieu of the lag screws;
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing;
- Ensuring safe installation of all electrical aspects of the PV array;
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer.

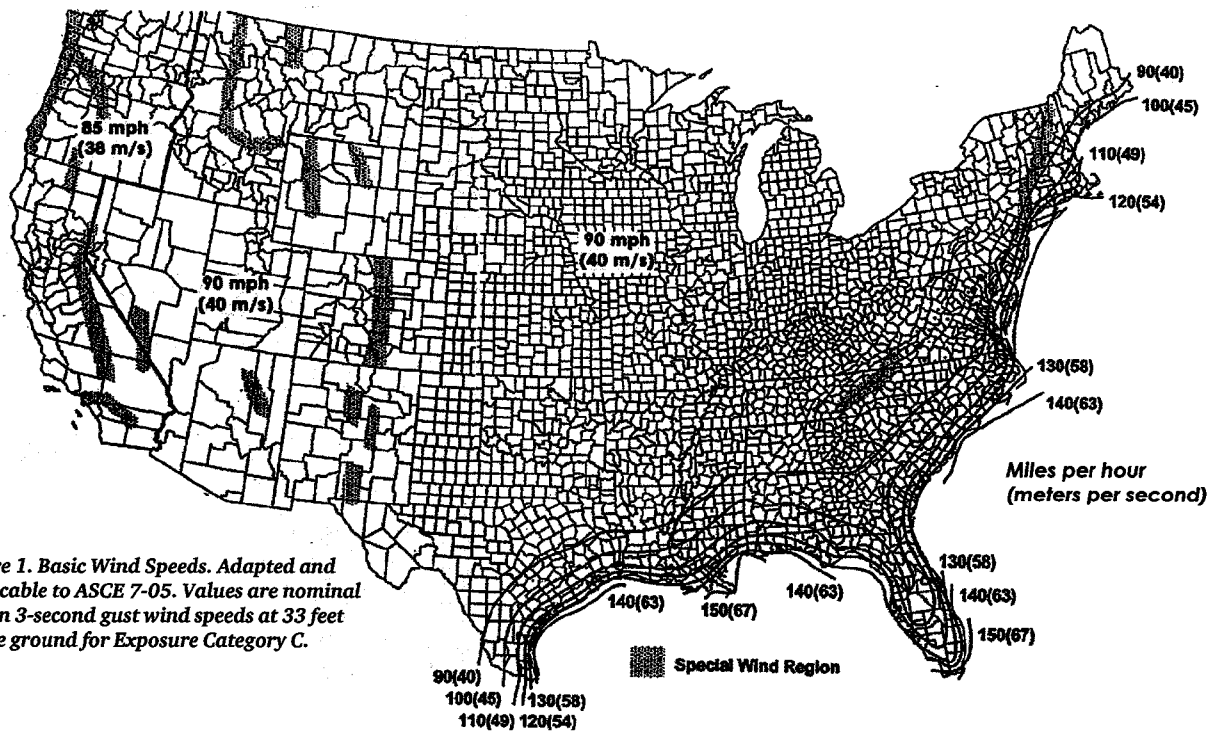


Figure 1. Basic Wind Speeds. Adapted and applicable to ASCE 7-05. Values are nominal design 3-second gust wind speeds at 33 feet above ground for Exposure Category C.

Step 3: Determine Roof/Wall Zone

The *Design Wind Load* will vary based on where the installation is located on a roof. Arrays may be located in more than one roof zone.

Using Table 1, determine the *Roof Zone Dimension Length, a* (ft), according to the width and height of the building on which you are installing the pv system.

Table 1. Determine Roof/Wall Zone, dimension (a) according to building width and height

a = 10 percent of the least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of the least horizontal dimension or 3 ft of the building.

Roof Height (ft)	Least Horizontal Dimension (ft)																		
	10	15	20	25	30	40	50	60	70	80	90	100	125	150	175	200	300	400	500
10	3	3	3	3	3	4	4	4	4	4	4	4	5	6	7	8	12	16	20
15	3	3	3	3	3	4	5	6	6	6	6	6	6	6	7	8	12	16	20
20	3	3	3	3	3	4	5	6	7	8	8	8	8	8	8	8	12	16	20
25	3	3	3	3	3	4	5	6	7	8	9	10	10	10	10	10	12	16	20
30	3	3	3	3	3	4	5	6	7	8	9	10	12	12	12	12	12	16	20
35	3	3	3	3	3	4	5	6	7	8	9	10	12.5	14	14	14	14	16	20
40	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	16	16	16	16	20
45	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	18	18	18	20
50	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	20	20	20
60	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	24	24	24

Source: ASCE/SEI 7-05, *Minimum Design Loads for Buildings and Other Structures*, Chapter 6, Figure 6-3, p. 41.

Table 2. p_{net30} (psf) Roof and Wall

Basic Wind Speed, V (mph)																		
	Zone	Effective Wind Area (sf)	90		100		110		120		130		140		150		170	
			Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift		
Roof 0 to 7 degrees	1	10	5.9	-14.6	7.3	-18.0	8.9	-21.8	10.5	-25.9	12.4	-30.4	14.3	-35.3	16.5	-40.5	21.1	-52.0
	1	20	5.6	-14.2	6.9	-17.5	8.3	-21.2	9.9	-25.2	11.6	-29.6	13.4	-34.4	15.4	-39.4	19.8	-50.7
	1	50	5.1	-13.7	6.3	-16.9	7.6	-20.5	9.0	-24.4	10.6	-28.6	12.3	-33.2	14.1	-38.1	18.1	-48.9
	1	100	4.7	-13.3	5.8	-16.5	7.0	-19.9	8.3	-23.7	9.8	-27.8	11.4	-32.3	13.0	-37.0	16.7	-47.6
	2	10	5.9	-24.4	7.3	-30.2	8.9	-36.5	10.5	-43.5	12.4	-51.0	14.3	-59.2	16.5	-67.9	21.1	-87.2
	2	20	5.6	-21.8	6.9	-27.0	8.3	-32.6	9.9	-38.8	11.6	-45.6	13.4	-52.9	15.4	-60.7	19.8	-78.0
	2	50	5.1	-18.4	6.3	-22.7	7.6	-27.5	9.0	-32.7	10.6	-38.4	12.3	-44.5	14.1	-51.1	18.1	-65.7
	2	100	4.7	-15.8	5.8	-19.5	7.0	-23.6	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	16.7	-56.4
	3	10	5.9	-36.8	7.3	-45.4	8.9	-55.0	10.5	-65.4	12.4	-76.8	14.3	-89.0	16.5	-102.2	21.1	-131.3
	3	20	5.6	-30.5	6.9	-37.6	8.3	-45.5	9.9	-54.2	11.6	-63.6	13.4	-73.8	15.4	-84.7	19.8	-108.7
	3	50	5.1	-22.1	6.3	-27.3	7.6	-33.1	9.0	-39.3	10.6	-46.2	12.3	-53.5	14.1	-61.5	18.1	-78.9
	3	100	4.7	-15.8	5.8	-19.5	7.0	-23.6	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	16.7	-56.4
Roof > 7 to 27degrees	1	10	8.4	-13.3	10.4	-16.5	12.5	-19.9	14.9	-23.7	17.5	-27.8	20.3	-32.3	23.3	-37.0	30.0	-47.6
	1	20	7.7	-13.0	9.4	-16.0	11.4	-19.4	13.6	-23.0	16.0	-27.0	18.5	-31.4	21.3	-36.0	27.3	-46.3
	1	50	6.7	-12.5	8.2	-15.4	10.0	-18.6	11.9	-22.2	13.9	-26.0	16.1	-30.2	18.5	-34.6	23.8	-44.5
	1	100	5.9	-12.1	7.3	-14.9	8.9	-18.1	10.5	-21.5	12.4	-25.2	14.3	-29.3	16.5	-33.6	21.1	-43.2
	2	10	8.4	-23.2	10.4	-28.7	12.5	-34.7	14.9	-41.3	17.5	-48.4	20.3	-56.2	23.3	-64.5	30.0	-82.8
	2	20	7.7	-21.4	9.4	-26.4	11.4	-31.9	13.6	-38.0	16.0	-44.6	18.5	-51.7	21.3	-59.3	27.3	-76.2
	2	50	6.7	-18.9	8.2	-23.3	10.0	-28.2	11.9	-33.6	13.9	-39.4	16.1	-45.7	18.5	-52.5	23.8	-67.4
	2	100	5.9	-17.0	7.3	-21.0	8.9	-25.5	10.5	-30.3	12.4	-35.6	14.3	-41.2	16.5	-47.3	21.1	-60.8
	3	10	8.4	-34.3	10.4	-42.4	12.5	-51.3	14.9	-61.0	17.5	-71.6	20.3	-83.1	23.3	-95.4	30.0	-122.5
	3	20	7.7	-32.1	9.4	-39.6	11.4	-47.9	13.6	-57.1	16.0	-67.0	18.5	-77.7	21.3	-89.2	27.3	-114.5
	3	50	6.7	-29.1	8.2	-36.0	10.0	-43.5	11.9	-51.8	13.9	-60.8	16.1	-70.5	18.5	-81.0	23.8	-104.0
	3	100	5.9	-26.9	7.3	-33.2	8.9	-40.2	10.5	-47.9	12.4	-56.2	14.3	-65.1	16.5	-74.8	21.1	-96.0
Roof >27 to 45 degrees	1	10	13.3	-14.6	16.5	-18.0	19.9	-21.8	23.7	-25.9	27.8	-30.4	32.3	-35.3	37.0	-40.5	47.6	-52.0
	1	20	13.0	-13.8	16.0	-17.1	19.4	-20.7	23.0	-24.6	27.0	-28.9	31.4	-33.5	36.0	-38.4	46.3	-49.3
	1	50	12.5	-12.8	15.4	-15.9	18.6	-19.2	22.2	-22.8	26.0	-26.8	30.2	-31.1	34.6	-35.7	44.5	-45.8
	1	100	12.1	-12.1	14.9	-14.9	18.1	-18.1	21.5	-21.5	25.2	-25.2	29.3	-29.3	33.6	-33.6	43.2	-43.2
	2	10	13.3	-17.0	16.5	-21.0	19.9	-25.5	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	47.6	-60.8
	2	20	13.0	-16.3	16.0	-20.1	19.4	-24.3	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	46.3	-58.1
	2	50	12.5	-15.3	15.4	-18.9	18.6	-22.9	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	44.5	-54.6
	2	100	12.1	-14.6	14.9	-18.0	18.1	-21.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	-40.5	43.2	-52.0
	3	10	13.3	-17.0	16.5	-21.0	19.9	-25.5	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	47.6	-60.8
	3	20	13.0	-16.3	16.0	-20.1	19.4	-24.3	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	46.3	-58.1
	3	50	12.5	-15.3	15.4	-18.9	18.6	-22.9	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	44.5	-54.6
	3	100	12.1	-14.6	14.9	-18.0	18.1	-21.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	-40.5	43.2	-52.0
Wall	4	10	14.6	-15.8	18.0	-19.5	21.8	-23.6	25.9	-28.1	30.4	-33.0	35.3	-38.2	40.5	-43.9	52.0	-56.4
	4	20	13.9	-15.1	17.2	-18.7	20.8	-22.6	24.7	-26.9	29.0	-31.6	33.7	-36.7	38.7	-42.1	49.6	-54.1
	4	50	13.0	-14.3	16.1	-17.6	19.5	-21.3	23.2	-25.4	27.2	-29.8	31.6	-34.6	36.2	-39.7	46.6	-51.0
	4	100	12.4	-13.6	15.3	-16.8	18.5	-20.4	22.0	-24.2	25.9	-28.4	30.0	-33.0	34.4	-37.8	44.2	-48.6
	4	500	10.9	-12.1	13.4	-14.9	16.2	-18.1	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	38.8	-43.2
	5	10	14.6	-19.5	18.0	-24.1	21.8	-29.1	25.9	-34.7	30.4	-40.7	35.3	-47.2	40.5	-54.2	52.0	-69.6
	5	20	13.9	-18.2	17.2	-22.5	20.8	-27.2	24.7	-32.4	29.0	-38.0	33.7	-44.0	38.7	-50.5	49.6	-64.9
	5	50	13.0	-16.5	16.1	-20.3	19.5	-24.6	23.2	-29.3	27.2	-34.3	31.6	-39.8	36.2	-45.7	46.6	-58.7
	5	100	12.4	-15.1	15.3	-18.7	18.5	-22.6	22.0	-26.9	25.9	-31.6	30.0	-36.7	34.4	-42.1	44.2	-54.1
	5	500	10.9	-12.1	13.4	-14.9	16.2	-18.1	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	38.8	-43.2

Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, Figure 6-3, p. 42-43.

Step 7: Determine adjustment factor for height and exposure category, λ

Using the *Exposure Category* (Step 6) and the *roof height, h (ft)*, look up the *adjustment factor for height and exposure* in Table 4.

Step 8: Determine the Importance Factor, I

Determine if the installation is in a hurricane prone region. Look up the *Importance Factor, I*, Table 6, page 9, using the occupancy category description and the hurricane prone region status.

Step 9: Calculate the Design Wind Load, p_{net} (psf)

Multiply the *Net Design Wind Pressure, p_{net30} (psf)* (Step 4) by the *adjustment factor for height and exposure, λ* (Step 7), the *Topographic Factor, K_{zt}* (Step 5), and the *Importance Factor, I* (Step 8) using the following equation, or Table 5 Worksheet.

$$p_{net} (psf) = \lambda K_{zt} I p_{net30}$$

p_{net} (psf) = Design Wind Load (10 psf minimum)

λ = adjustment factor for height and exposure category (Step 7)

K_{zt} = Topographic Factor at mean roof height, h (ft) (Step 5)

I = Importance Factor (Step 8)

p_{net30} (psf) = net design wind pressure for Exposure B, at height = 30, $I = 1$ (Step 4)

Use Table 5 below to calculate Design Wind Load.

The Design Wind Load will be used in **Part II** to select the appropriate SolarMount Series rail, rail span and foot spacing.

In **Part II**, use both the positive (downforce) and the negative (uplift) results from this calculation.

Table 4. Adjustment Factor (λ) for Roof Height & Exposure Category

Mean roof height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Source: ASCE/SEI 7-05, *Minimum Design Loads for Buildings and Other Structures*, Chapter 6, Figure 6-3, p. 44.

Table 5. Worksheet for Components and Cladding Wind Load Calculation: IBC 2009, ASCE 7-05

Variable Description	Symbol	Value	Unit	Step	Reference
Building Height	h		ft		
Building, Least Horizontal Dimension			ft		
Roof Pitch			degrees		
Exposure Category				6	
Basic Wind Speed	V		mph	1	Figure 1
Effective Wind Area			sf		
Roof Zone Setback Length	a		ft	2	
Roof Zone Location				3	Table 1
Net Design Wind Pressure	p_{net30}		psf	3	Figure 2
Topographic Factor	K_{zt}	x		4	Table 2, 3
Adjustment factor for height and exposure category	λ	x		5	
Importance Factor	I	x		7	Table 4
				8	Table 5
Total Design Wind Load	p_{net}		psf	9	

Part II. Procedure to Select Rail Span and Rail Type

[2.1.] Using Standard Beam Calculations, Structural Engineering Methodology

The procedure to determine the Unirac SolarMount series rail type and rail span uses standard beam calculations and structural engineering methodology. The beam calculations are based on a simply supported beam conservatively, ignoring the reductions allowed for supports of continuous beams over multiple supports. Please refer to **Part I** for more information on beam calculations, equations and assumptions. If beams are installed perpendicular to the eaves on a roof steeper than a 4/12 pitch in an area with a ground snow load greater than 30psf, then additional analysis is required for side loading on the roof attachment and beam.

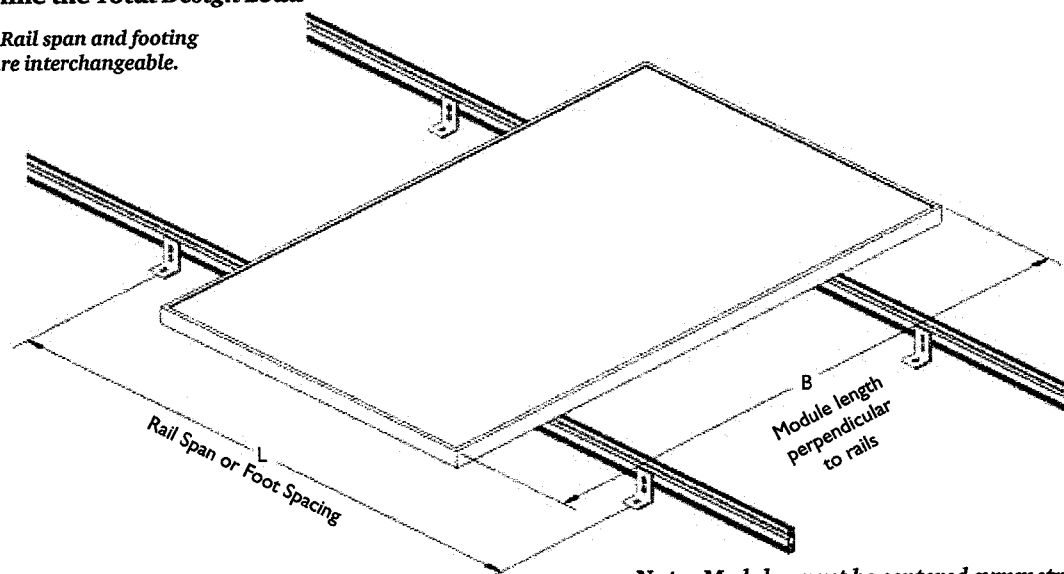
In using this document, obtaining correct results is dependent upon the following:

1. Obtain the *Snow Load* for your area from your local building official.
2. Obtain the *Design Wind Load, p_{net}* . See **Part I** (Procedure to Determine the Design Wind Load) for more information on calculating the *Design Wind Load*.
3. **Please Note:** The terms rail span and footing spacing are interchangeable in this document. See **Figure 3** for illustrations.
4. To use **Table 8**, the *Dead Load* for your specific installation must be less than 5 psf, including modules and Unirac racking systems. If the Dead Load is greater than 5 psf, see your Unirac distributor, a local structural engineer or contact Unirac.

The following procedure will guide you in selecting a Unirac rail for a flush mount installation. It will also help determine the design loading imposed by the Unirac PV Mounting Assembly that the building structure must be capable of supporting.

Step 1: Determine the Total Design Load

Figure 3. Rail span and footing spacing are interchangeable.



Note: Modules must be centered symmetrically on the rails (+/- 2*), as shown in Figure 3.

The *Total Design Load, P (psf)* is determined using ASCE 7-05 2.4.1 (ASD Method equations 3,5,6 and 7) by adding the *Snow Load¹, S (psf)*, *Design Wind Load, p_{net} (psf)* from **Part I, Step 9** and the *Dead Load (psf)*. Both Uplift and Downforce Wind Loads calculated in **Step 9 of Part 1** must be investigated. Use **Table 7** to calculate the Total Design Load for the load cases. Use the maximum absolute value of the three downforce cases and the uplift case for sizing the rail. Use the uplift case only for sizing lag bolts pull out capacities (**Part II, Step 6**). Use the following equations or **Table 7**.

$$P \text{ (psf)} = 1.0D + 1.0S^1 \text{ (downforce case 1)}$$

$$P \text{ (psf)} = 1.0D + 1.0p_{net} \text{ (downforce case 2)}$$

$$P \text{ (psf)} = 1.0D + 0.75S^1 + 0.75p_{net} \text{ (downforce case 3)}$$

$$P \text{ (psf)} = 0.6D + 1.0p_{net} \text{ (uplift)}$$

$$D = \text{Dead Load (psf)}$$

$$S = \text{Snow Load (psf)}$$

$$p_{net} = \text{Design Wind Load (psf) (Positive for downforce, negative for uplift)}$$

The maximum Dead Load, D (psf), is 5 psf based on market research and internal data.

¹ *Snow Load Reduction* - The snow load can be reduced according to Chapter 7 of ASCE 7-05. The reduction is a function of the roof slope, Exposure Factor, Importance Factor and Thermal Factor. Please refer to Chapter 7 of ASCE 7-05 for more information.

Step 4: Select Rail Type

Selecting a span and rail type affects the price of your installation. Longer spans produce fewer wall or roof penetrations. However, longer spans create higher point load forces on the building structure. A point load force is the amount of force transferred to the building structure at each connection.

It is the installer's responsibility to verify that the building structure is strong enough to support the point load forces.

Step 5: Determine the Downforce Point Load, R (lbs), at each connection based on rail span

When designing the Unirac Flush Mount Installation, you must consider the downforce Point Load, R (lbs) on the roof structure.

The *Downforce, Point Load, R (lbs)*, is determined by multiplying the *Total Design Load, P (psf)* (Step 1) by the *Rail Span, L (ft)* (Step 3) and the *Module Length Perpendicular to the Rails, B (ft)* divided by two.

$$R \text{ (lbs)} = PLB/2$$

R = Point Load (lbs)

P = Total Design Load (psf)

L = Rail Span (ft)

B = Module Length Perpendicular to Rails (ft)

It is the installer's responsibility to verify that the building structure is strong enough to support the maximum point loads calculated according to Step 5.

Table 10. Downforce Point Load Calculation

Total Design Load (downforce) (max of case 1, 2 or 3):	P		psf	Step 1
Module length perpendicular to rails:	B	x	ft	
Rail Span:	L	x	ft	Step 4
		/2		
Downforce Point Load:	R		lbs	

Part III. Installing SolarMount

The Unirac Code-Compliant Installation Instructions support applications for building permits for photovoltaic arrays using Unirac PV module mounting systems.

This manual, SolarMount Planning and Assembly, governs installations using the SolarMount and SolarMount HD (Heavy Duty) systems.

[3.1.] SolarMount rail components

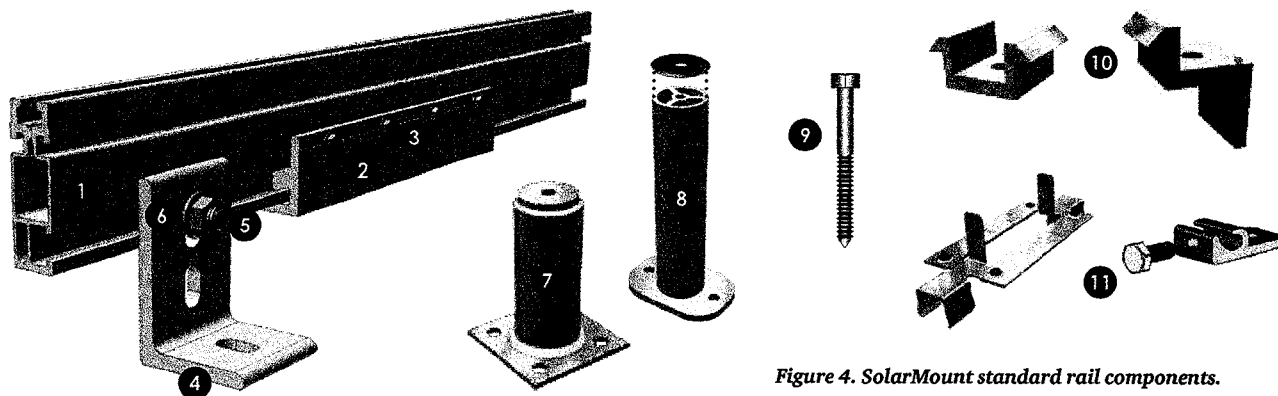


Figure 4. SolarMount standard rail components.

- 1 **Rail** – Supports PV modules. Use two per row of modules. Aluminum extrusion, anodized.
- 2 **Rail splice** – Joins and aligns rail sections into single length of rail. It can form either a rigid or thermal expansion joint, 8 inches long, predrilled. Aluminum extrusion, anodized.
- 3 **Self-drilling screw** – (No. 10 x 3/4") – Use 4 per rigid splice or 2 per expansion joint. Galvanized steel.
- 4 **L-foot** – Use to secure rails either through roofing material to building structure or standoffs. Refer to loading tables for spacing. Note: Please contact Unirac for use and specification of double L-foot.
- 5 **L-foot bolt** (3/8" x 3/4") – Use one per L-foot to secure rail to L-foot. Stainless steel.
- 6 **Flange nut** (3/8") – Use one per L-foot to secure rail to L-foot. Stainless steel.
- 7 **Flat-top standoff** (optional) (3/8") – Use standoffs to increase the height of the array above the surface of the roof or to allow for the use of flashings. Use one per L-foot. One piece: Service Condition 4 (very severe) zinc-plated-welded steel. Includes 3/8" x 3/4" bolt with

lock washer for attaching L-foot. Flashings: Use one per standoff. Unirac offers appropriate flashings for both standoff types.

Note: There is also a flange type standoff that does not require an L-foot.

- 8 **Aluminum two-piece standoff** (optional) (4" and 7") – Use one per L-foot. Two-piece: Aluminum extrusion. Includes 3/8" x 3/4" serrated flange bolt with EPDM washer for attaching L-foot, and two 5/16" lag bolts.
- 9 **Lag screw for L-foot** (5/16") – Attaches standoff to rafter.
- 10 **Top Mounting Clamps**
- 11 **Top Mounting Grounding Clips and Lugs**

Installer supplied materials:

- **Lag screw for L-foot** – Attaches L-foot or standoff to rafter. Determine the length and diameter based on pull-out values. If lag screw head is exposed to elements, use stainless steel. Under flashings, zinc plated hardware is adequate.
- **Waterproof roofing sealant** – Use a sealant appropriate to your roofing material. Consult with the company currently providing warranty of roofing.

[3.2.1] Planning your SolarMount installations

The installation can be laid out with rails parallel to the rafters or perpendicular to the rafters. Note that SolarMount rails make excellent straight edges for doing layouts.

Center the installation area over the structural members as much as possible.

Leave enough room to safely move around the array during installation. Some building codes require minimum clearances around such installations, and the user should be directed to also check 'The Code'.

The width of the installation area equals the length of one module.

The length of the installation area is equal to:

- the total width of the modules,
- plus 1 inch for each space between modules (for mid-clamp),
- plus 3 inches (1½ inches for each pair of end clamps).

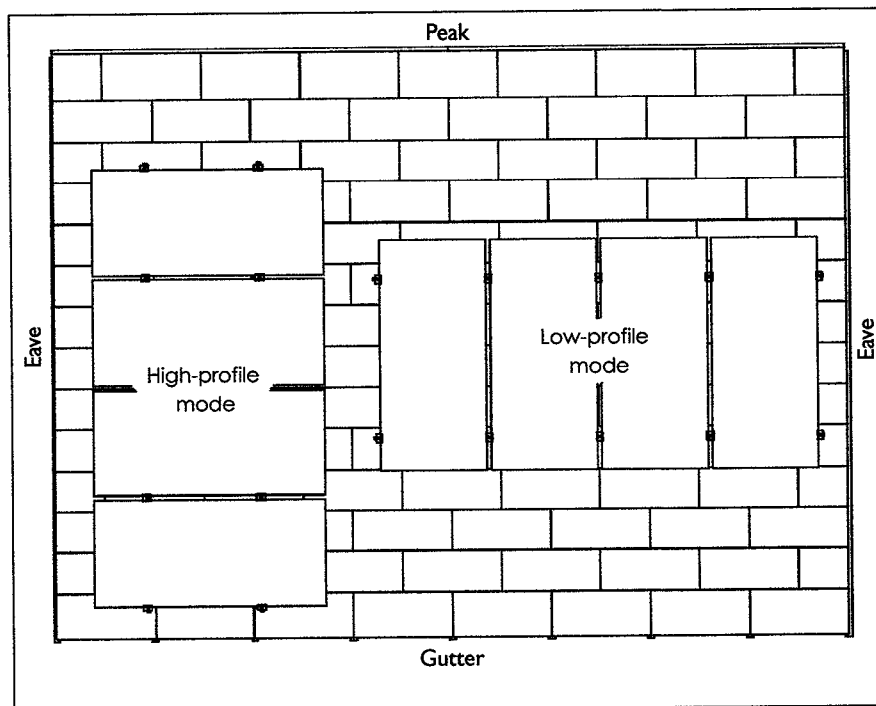


Figure 6. Rails may be placed parallel or perpendicular to rafters.

[3.2.3] Laying out standoffs

Standoffs (Figure 10) are used to increase the height of the array above the surface of the roof. Pair each standoff with a flashing to seal the lag bolt penetrations to the roof.

Use Figure 11 or 12 to locate and mark the location of the standoff lag screw holes within the installation area.

Remove the tile or shake underneath each standoff location, exposing the roofing underlayment. Ensure that the standoff base lies flat on the underlayment, but remove no more material than required for the flashings to be installed properly.

The standoffs must be firmly attached to the building structure.

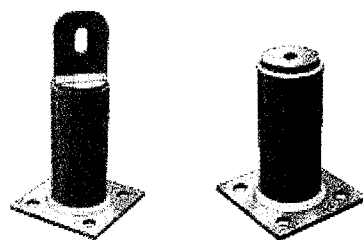


Figure 10. Raised flange standoff (left) and flat top standoff used in conjunction with an L-foot.

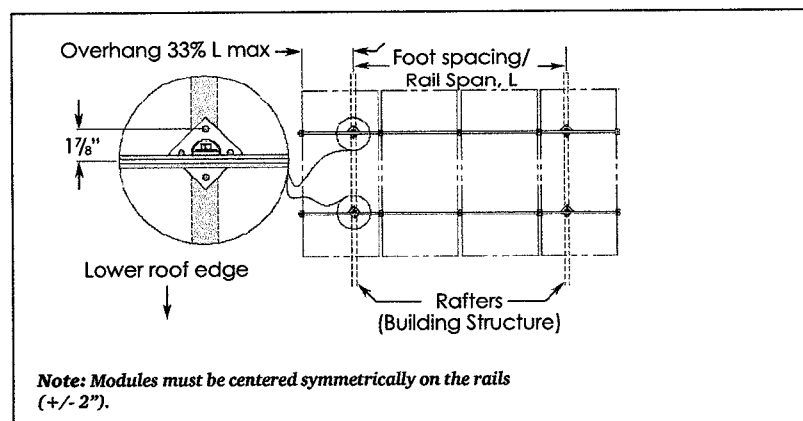


Figure 11. Layout with rails perpendicular to rafters. perpendicular to rafters.

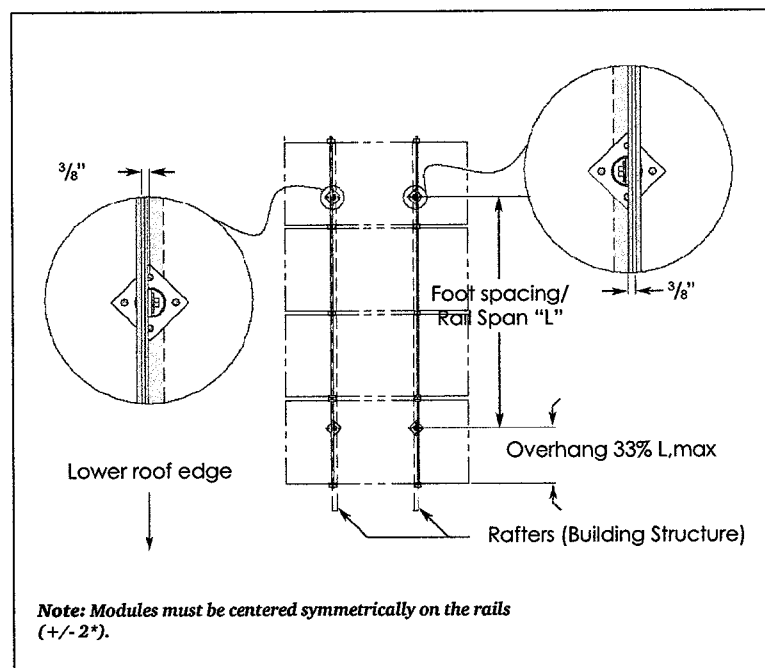


Figure 12. Layout with rails parallel to rafters.

If multiple high-profile rows are to be installed adjacent to each other, it may not be possible for each row to be centered above the rafters. Adjust as needed, following the guidelines of Fig. 12 as closely as possible.

Installing standoffs:

Drill 3/16 inch pilot holes through the underlayment into the center of the rafters at each standoff location. Securely fasten each standoff to the rafters with the two 5/16" lag screws.

Ensure that the standoffs face as shown in Figure 11 or 12.

Unirac steel and aluminum two-piece standoffs (1-5/8" O.D.) are designed for collared flashings available from Unirac.

Install and seal flashings and standoffs using standard building practices or as the company providing roofing warranty directs.

[3.2.5] Installing the modules

Pre-wiring Modules: If modules are the Plug and Play type, no pre-wiring is required, and you can proceed directly to "Installing the First Module" below.

If modules have standard J-boxes, each module should be pre-wired with one end of the intermodule cable for ease of installation. For safety reasons, module pre-wiring should not be performed on the roof.

Leave covers off J-boxes. They will be installed when the modules are installed on the rails.

Installing the First Module: In high-profile installations, the best practice would be to install a safety bolt ($\frac{1}{4}$ "-20 x $\frac{1}{2}$ ") and flange nut (both installer provided) fastened to the module bolt slot at the aligned (lower) end of each rail. It will prevent the lower end clamps and clamping bolts from sliding out of the rail slot during installation.

If there is a return cable to the inverter, connect it to the first module. Close the J-box cover. Secure the first module with T-bolts and end clamps at the aligned end of each rail. Allow half an inch between the rail ends and the end clamps (Fig. 18). Finger tighten flange nuts, center and align the module as needed, and securely tighten the flange nuts (10 ft lbs).

Installing the Other Modules: Lay the second module face down (glass to glass) on the first module. Connect intermodule cable to the second module and close the J-box cover. Turn the second module face up (Fig. 17). With T-bolts, mid-clamps and flange nuts, secure the adjacent sides of the first and second modules. Align the second module and securely tighten the flange nuts (Fig. 19).

For a neat installation, fasten wire management devices to rails with self-drilling screws.

Repeat the procedure until all modules are installed. Attach the outside edge of the last module to the rail with end clamps.

Trim off any excess rail, being careful not to cut into the roof. Allow half an inch between the end clamp and the end of the rail (Fig. 18).

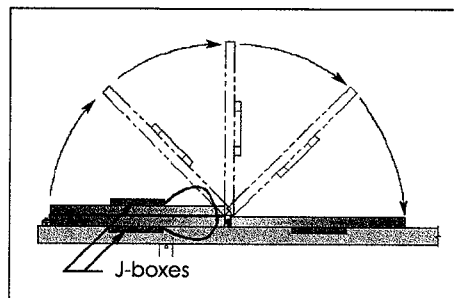


Figure 17

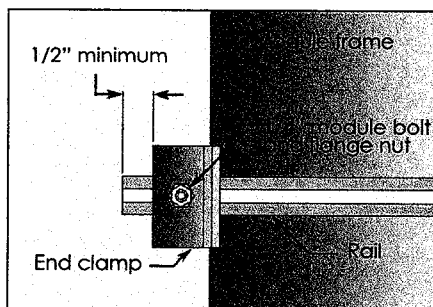


Figure 18

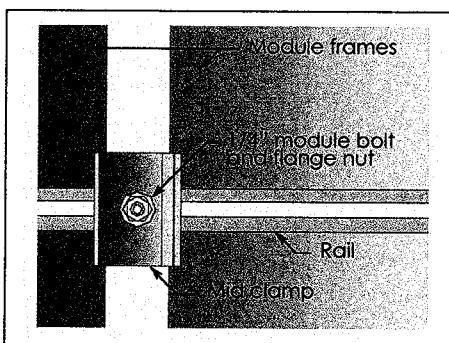


Figure 19

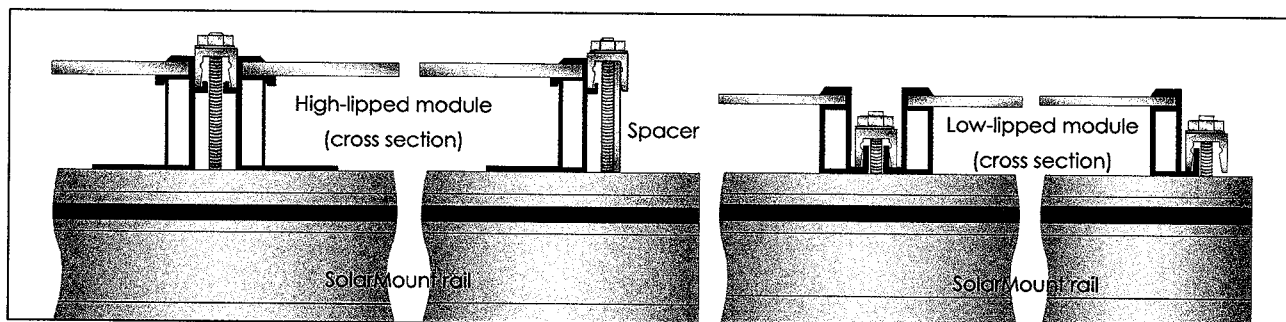


Figure 20. Mid clamps and end clamps for lipped-frame modules are identical. A spacer for the end clamps is necessary only if the lips are located high on the module frame.

[3.3.1] Planning the installation area

Decide on an arrangement for clips, rails, and L-feet (Fig. 22).

Use Arrangement A if the full width of the rails contacts the module. Otherwise use Arrangement B.

Caution: If you choose Arrangement B, either
(1) use the upper mounting holes of the L-feet or
(2) be certain that the L-feet and clip positions don't conflict.

If rails must be parallel to the rafters, it is unlikely that they can be spaced to match rafters. In that case, add structural supports – either sleepers over the roof or mounting blocks beneath it. These additional members must meet code; if in doubt, consult a professional engineer.

Never secure the footings to the roof decking alone. Such an arrangement will not meet code and leaves the installation and the roof itself vulnerable to severe damage from wind.

Leave enough room to safely move around the array during installation. The width of a rail-module assembly equals the length of one module. Note that L-feet may extend beyond the width of the assembly by as much as 2 inches on each side. The length of the assembly equals the total width of the modules.

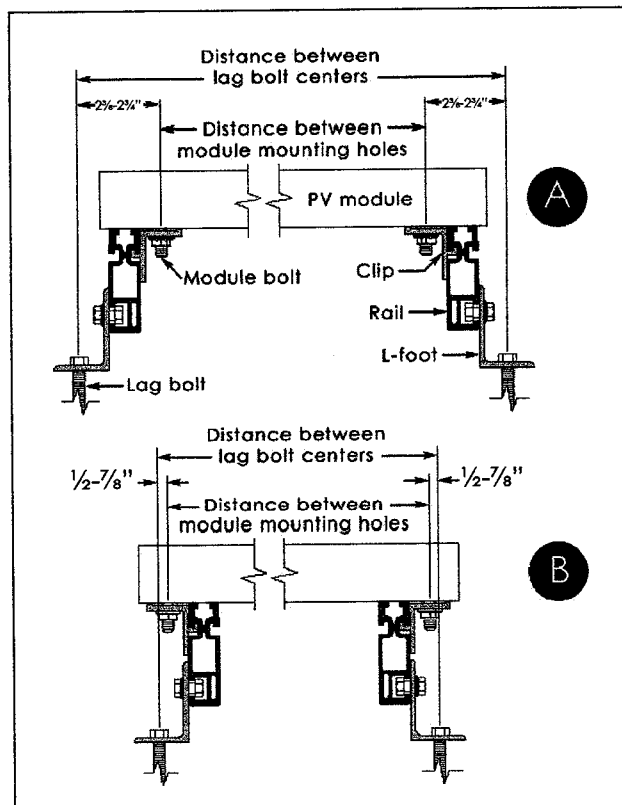


Figure 22. Clip Arrangements A and B

[3.3.3] Attaching modules to the rails

Lay the modules for a given panel face down on a surface that will not damage the module glass. Align the edges of the modules and snug them together (Fig. 21, page 22).

Trim the rails to the total width of the modules to be mounted. Place a rail adjacent to the outer mounting holes. Orient the footing bolt slot outward. Place a clip slot adjacent to the mounting holes, following the arrangement you selected earlier.

Assemble the clips, mounting bolts, and flange nuts. Torque the flange nuts to 10 foot-pounds.

[3.3.4] Installing the module-rail assembly

Bring the module-rail assembly to the installation site. Keep rail slots free of debris that might cause bolts to bind in the slots.

Consider the weight of a fully assembled panel. Unirac recommends safety lines whenever lifting one to a roof.

Align the panel with the previously installed L-feet. Slide 3/8 inch L-foot mounting bolts onto the rail and align them with the L-foot mounting holes. Attach the panel to the L-feet and finger tighten the flange nuts.

Rails may be attached to either of two mounting holes in the footings (Fig. 25).

- Mount in the lower hole for a low, more aesthetically pleasing installation.
- Or mount in the upper hole to maximize a cooling airflow under the modules. This may enhance performance in hotter climates.

Adjust the position of the panel as needed to fit the installation area. Slide the remaining L-feet bolts onto the other rail, attach L-feet, and finger tighten with flange nuts. Align L-feet with mounting holes previously drilled into the roof. Install lag bolts into remaining L-feet as described in "Laying out and installing L-feet" above.

Torque all footing flange nuts to 30 foot-pounds. Verify that all lag bolts are securely fastened.

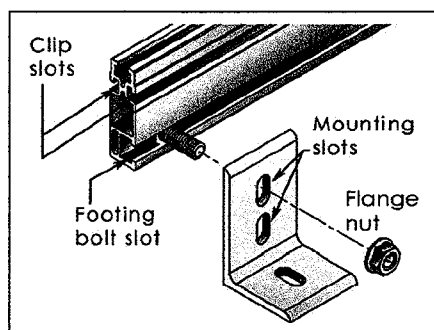


Figure 25. Leg-to-rail attachment

Warranty Information

See <http://www.unirac.com> for current warranty documents and information.

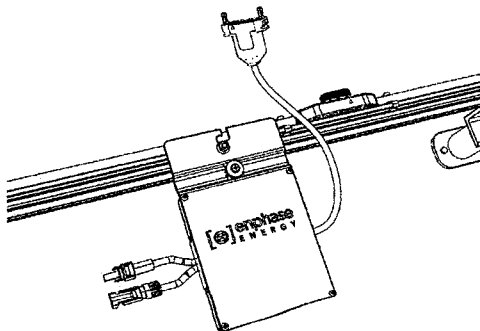
4

M215 Microinverter Quick Install Guide

3

Attach the Microinverters to the PV Racking

- a. Mark the approximate centers of each PV module on the PV racking. See notes in *Step Details* on back.



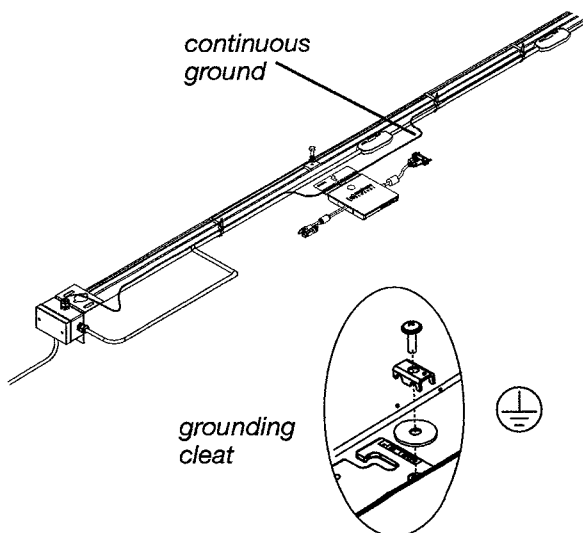
- b. Mount the microinverters under the PV module, away from rain and sun. Do not mount the microinverter in a position that allows long-term exposure to direct sunlight or in a vertical orientation that allows water to collect in the DC connector recess.

- c. Torque the microinverter fasteners as follows:
- 5 N m (45-50 in-lbs) for 6 mm (1/4") hardware
 - 9 N m (80-85 in-lbs) for 8 mm (5/16") hardware

4

Ground the Microinverters

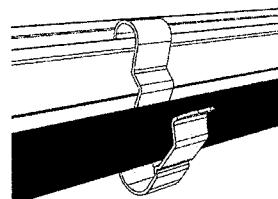
- a. Ground the microinverters using the grounding cleat with a continuous ground wire. See notes in *Step Details* on back.
- b. Torque the 10/32 grounding cleat screw to 2 N m (20-25 in-lbs) minimum.



5

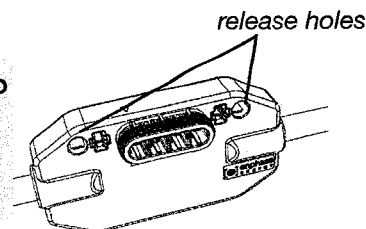
Dress the Cable

- a. Attach the cabling to the rack using cable clips or tie wraps.
- b. Dress any excess cabling in loops so that it does not contact the roof.



cable clip

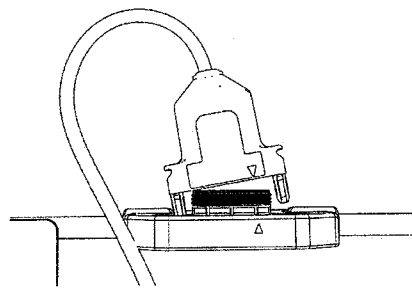
Keep the drop connector release holes clear and accessible.



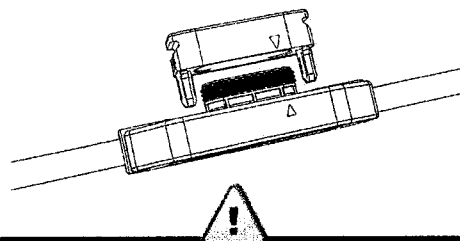
6

Connect the Microinverters

- a. Remove and discard the temporary shipping cap from the cable connector and connect the microinverter. Listen for two clicks as the connectors engage.



- b. Cover any unused connectors with sealing caps. Listen for two clicks as the connectors engage. See notes in *Step Details* on back.

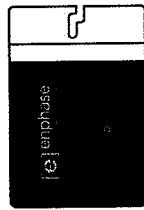


Do not use shipping caps to cover unused connectors. The shipping cap does not provide an adequate environmental seal.

11

Energize the System

- Turn ON the AC disconnect or circuit breaker for the branch circuit.
- Turn ON the main utility-grid AC circuit breaker. Your system will start producing power **after a five-minute wait time**.



status LED

One minute after DC power is applied, the status LED on the underside of each M215 will blink green six times to indicate normal start up.

12

Next Step

Refer to the *Envoy Communications Gateway Quick Install Guide* for information on Envoy® installation and Enlighten® access.

Step Details

1

240 Volt AC Split Phase		208 Volt AC Three Phase	
L1 to L2	211 to 264 VAC	L1 to L2 to L3	183 to 229 VAC
L1, L2, to N	106 to 132 VAC	L1, L2, L3 to N	106 to 132 VAC

2

WARNING: Only use electrical system components approved for wet locations.

WARNING: Do NOT exceed the maximum number of micro-inverters in an AC branch circuit as listed in the table below. Each branch circuit must be protected by a dedicated circuit breaker of 20 A or less.

Service type	Max M215s per branch
240 VAC split phase	17
208 VAC three phase	25

WARNING: Size the AC wire gauge to account for voltage drop for both the branch circuit and all upstream conductors leading back to the PCC. See *Circuit Calculations for M215* at <http://www.enphase.com/support>.

3

WARNING: Allow a minimum of 1.9 cm (0.75") between the roof and the microinverter. Also allow 1.3 cm (0.50") between the back of the PV module and the top of the microinverter.

NOTE: Torque the microinverter fasteners to the values shown. Do not over torque:

- 6 mm (1/4") mounting hardware – 5 N m (45-50 in-lbs) minimum
- 8 mm (5/16") mounting hardware – 9 N m (80-85 in-lbs) minimum

Using a power screwdriver is not recommended due to the risk of thread galling.

4

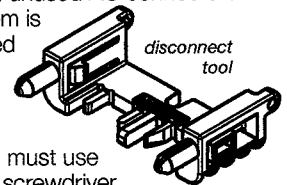
NOTE: The AC output neutral is not bonded to ground inside the microinverter.

NOTE: The M215 grounding cleat can accommodate a 6-8 AWG conductor. Torque the 10/32 grounding cleat screw to 2 N m (20-25 in-lbs) minimum. Do not over torque. Using a power screwdriver is not recommended due to the risk of thread galling.

6

WARNING: Install sealing caps on all unused AC connectors as these become live when the system is energized by the utility. The IP67-rated sealing caps are required for UL compliance and to protect against moisture ingress.

NOTE: To remove a sealing cap, you must use the Enphase disconnect tool or a #2 screwdriver.



8

NOTE: The Engage Cable uses the following wiring scheme.

240 Volt AC, Split Phase Wiring	208 Volt AC, Three Phase Wiring
Black – L1	Black – L1
Red – L2	Red – L2
White – Neutral	Blue – L3
Green – Ground	White – Neutral
	Green – Ground

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⚠	WARNING: Do NOT exceed the maximum number of microinverters in an AC branch circuit as listed in the manual. You must protect each microinverter AC branch circuit with a 20A maximum breaker.
⚠	WARNING: DO NOT connect Enphase Microinverters to the grid or energize the AC circuit(s) until you have completed all of the installation procedures and have received prior approval from the electrical utility company.
⚠	WARNING: Do not attempt to repair the Enphase Microinverter; it contains no user-serviceable parts. If it fails, contact Enphase customer service to obtain an RMA (return merchandise authorization) number and start the replacement process. Tampering with or opening the Enphase Microinverter will void the warranty.
⚠	WARNING: Be aware that only qualified personnel must connect the Enphase Microinverter to the utility grid.
⚠	WARNING: Be aware that installation of this equipment includes risk of electric shock. Normally grounded conductors may be ungrounded and energized when a ground fault is indicated.
⚠	WARNING: Always disconnect AC power before disconnecting the PV module wires from the Enphase Microinverter. The AC connector of the microinverter is suitable as a disconnecting means.
⚠	WARNING: The Engage Cable terminator cap is intended for one-time use only. If you open the terminator after initial installation, the latching mechanism is destroyed and the terminator cap cannot be used again. If the latching mechanism is defective, the terminator must not be used. The latching mechanism must not be circumvented or manipulated.
⚠	WARNING: When stripping the sheath from the Engage Cable, make sure that the conductors are not damaged. If the exposed wires are damaged, the system may not function properly.
⚠	WARNING: Perform all electrical installations in accordance with all applicable local electrical codes and the National Electrical Code (NEC), ANSI/NFPA 70.
✓	NOTE: Check the labeling on the Engage Cable drop connectors to be sure that the cable matches the electrical utility service at the site. Use 208 VAC (208 VAC three-phase) Engage Cable at sites with three-phase 208 VAC service, or use 240 VAC Engage Cable at sites with 240 VAC single-phase service.
✓	NOTE: When installing the Engage Cable and accessories, adhere to the following: • Do not expose the connection to directed, pressurized liquid (water jets, etc.). • Do not expose the connection to continuous immersion. • Do not expose the AC connector to continuous tension (e.g., tension due to pulling or bending the cable near the connection). • Use only the connectors and cables provided. • Do not allow contamination or debris in the connectors. • Use the cable and connectors only when all parts are present and intact. • Fit the connections using only the prescribed tools. • Use the terminator to seal the conductor end of the Engage Cable; no other method is allowed.
✓	NOTE: When installing the Engage Cable, secure any loose cable to minimize tripping hazard.
✓	NOTE: Using a power screwdriver to tighten the fastener and/or the grounding cleat screw is not recommended due to the risk of thread galling.

✓	NOTE: There are two release-holes in the drop connector on the cable. These are not for mounting but are used to disconnect the connector. Keep these release holes clear and accessible.
✓	NOTE: The Status LED on the underside of each microinverter will blink green six times to indicate normal start-up operation approximately one minute after DC power is applied.
✓	NOTE: The AC output neutral is not bonded to ground inside the microinverter.
✓	NOTE: Protection against lightning and resulting voltage surge must be in accordance with local standards.
✓	NOTE: Many PV modules have a central stiffening brace. In these cases, do not position the connector and microinverter at the exact center of the PV module. Instead, position the drop connectors so that the connectors do not conflict with the braces.
✓	NOTE: If you need to remove a sealing cap, you must use the Enphase disconnect tool or a #3 Phillips screwdriver. Sealing caps may not be reused.
✓	NOTE: The M215-60-2LL works with split phase 240VAC utility service or with three phase 208VAC utility service
✓	NOTE: Do not use the shipping cap to cover unused connectors. The shipping cap does not provide an adequate environmental seal. Enphase sealing caps are required for the system to be UL compliant and to protect against moisture ingress.
✓	NOTE: Completely install all microinverters and all system AC connections prior to installing the PV modules.

Installation Map

You can build the system map manually, or you can use the ArrayGun feature from the Enphase Installer Toolkit to easily build and configure a system. For more information, refer to <http://enphase.com/products/arraygun/>.

To manually build the Installation Map:

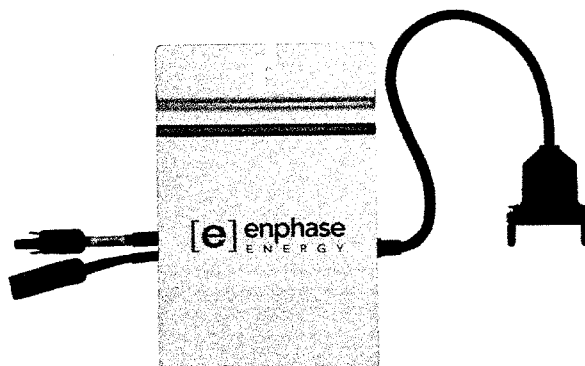
- Peel the removable serial number label from each microinverter and affix it to the respective location on the installation map.
- Peel the label from the Envoy and affix it to the installation map.
- Log in to Enlighten.
- Scan the installation map and upload it to the Activation form online.
- Use Array Builder to create the virtual array using the installation map as your reference.
- To see the array builder demo, refer to <http://enphase.com/support/videos>.

M215 Microinverter Installation Planning

The M215 Microinverter

The M215 Microinverter™ is a powerful and efficient grid-tied microinverter. It is compatible with most 60-cell PV modules (up to 270 Watts or higher) and installs quickly and easily. It works with both three-phase 208 Vac or single-phase 240 Vac services in North America. A separate model is available for 230 Vac service in other regions.

For detailed installation information, refer to the **M215 Installation and Operations Manual** and the **M215 Quick Install Guide** at <http://www.enphase.com/support/downloads>.



Microinverter Compatibility

The M215 pairs only with a 60-cell PV module. Refer to <http://www.enphase.com/support/downloads> for a list of **electrically**-compatible PV modules. To ensure **mechanical** compatibility, be sure to order the correct module connector type for both the M215 and PV module.

Model Number	Electrical Compatibility	Module Connector Type
M215-60-2LL-S22 M215-60-2LL-S22-NA	60 cell PV module	MC-4 Type 2 Locking or Amphenol H4 Locking
M215-60-2LL-S23 M215-60-2LL-S23-NA	60 cell PV module	Tyco Solarlock Locking*

***Note:** Tyco connectors on PV modules can vary in polarity, and either the male or female connector may be positive. Only the MALE positive will mate with Enphase Microinverters with S23 connectors. Be sure to order the correct connector type for both microinverter and PV module from your distributor.

As a rule, the electrically-positive output of the PV module always connects to the positive input of the microinverter. However, PV modules come with a variety of labels. For more information, refer to **Mating Microinverters with PV Modules for Correct Polarity** at <http://www.enphase.com/support/downloads>.

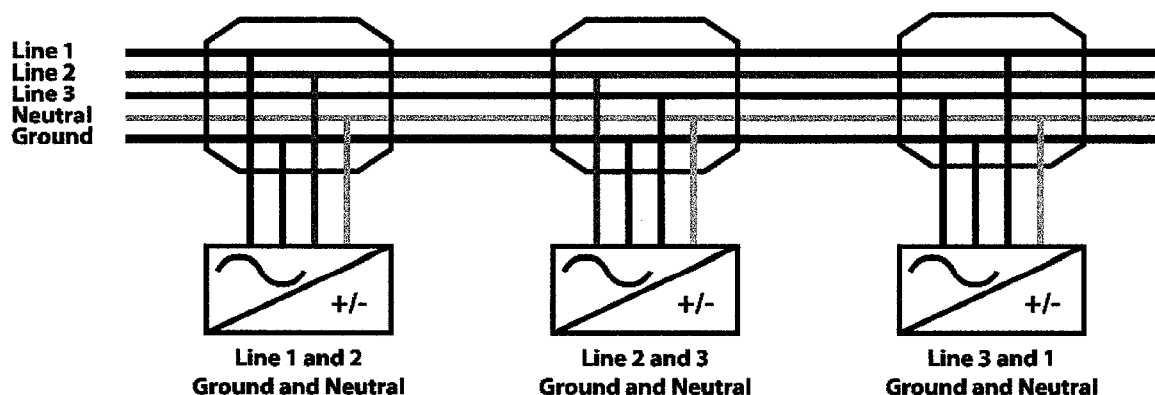
Branch Circuit Capacity

Do not exceed the maximum number of microinverters in an AC branch circuit as listed in the following table. You must protect each microinverter AC branch circuit with a 20A maximum breaker.

Maximum number of M215s per 20 amp AC Branch Circuit	
Service type	Max M215s per AC branch
240V	17
208V	25

Voltage Types and Conductor Count

In North America, the Engage Cable is available for either 240VAC split phase or 208VAC three phase. **All cable connectors bear labels indicating their cable voltage designation.** Typically used for residential applications, 240VAC cabling includes four conductors. Three-phase 208VAC cabling includes five conductors, and is used for most commercial installations. Because Enphase microinverters output onto two phases, three phase cabling balances the phases by rotating the conductors from one microinverter to the next as shown in the following diagram.



Cabling Length Options

Engage Cabling is available in shorter lengths with 30 or 40 connectors, depending upon voltage type. Longer lengths can be ordered and cut to suit per order. Ordering options include:

Model Number	Voltage type/ conductor #	Connector count	Connector spacing	PV module orientation	Approx. weight
ET10-240-40	240VAC, 4 conductor	40 connectors	1.025 m (40")	Portrait	18.1 kg (40 lbs)
ET17-240-40	240VAC, 4 conductor	40 connectors	1.7 m (67")	Landscape	20.4 kg (45 lbs)
ET10-208-30	208VAC, 5 conductor	30 connectors	1.025 m (40")	Portrait	13.6 kg (30 lbs)
ET17-208-30	208VAC, 5 conductor	30 connectors	1.7 m (67")	Landscape	15.9 kg (35 lbs)
ET10-240-BULK	240VAC, 4 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-240-BULK	240VAC, 4 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)
ET10-208-BULK	208VAC, 5 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-208-BULK	208VAC, 5 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)